

IAEA activities in support of study and preservation of Cultural Heritage

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International Atomic Energy Agency

Outline:

- IAEA objective, functions and main pillars of work
- Introduction to NAPC
 - PS-NSIL
 - RIRT
- Why to support CH studies?
 - Rationale
 - NT suitable to support CH
- IAEA activities in support of CH studies
 - Regular Budget
 - Technical and Consultancy meetings
 - Coordinated Research Projects
 - Publications
 - TC projects
 - National
 - Regional
- Concluding remarks and recommendations

IAEA objective:

The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose

IAEA functions:

- 1. To encourage and assist research on, and development and practical application of, atomic energy for peaceful uses** throughout the world; and, if requested to do so, to act as an intermediary for the purposes of securing the performance of services or the supplying of materials, equipment, or facilities by one member of the Agency for another; and to perform any operation or service useful in research on, or development or practical application of, atomic energy for peaceful purposes;
- 2. To make provision,** in accordance with this Statute, **for materials, services, equipment, and facilities** to meet the needs of research on, and development and practical application of, atomic energy for peaceful purposes, including the production of electric power, with due consideration for the needs of the under-developed areas of the world;

IAEA functions:

- 3. To foster the exchange of scientific and technical information** on peaceful uses of atomic energy;
- 4. To encourage the exchange of training of scientists and experts** in the field of peaceful uses of atomic energy;
- 5. To establish and administer safeguards** designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy;

IAEA functions:

- 6. To establish or adopt**, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, **standards of safety for protection of health and minimization of danger to life and property** (including such standards for labour conditions), and to provide for the application of these standards to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangements, or, at the request of a State, to any of that State's activities in the field of atomic energy;
- 7. To acquire or establish any facilities, plant and equipment useful** in carrying out its authorized functions, whenever the facilities, plant, and equipment otherwise available to it in the area concerned are inadequate or available only on terms it deems unsatisfactory.

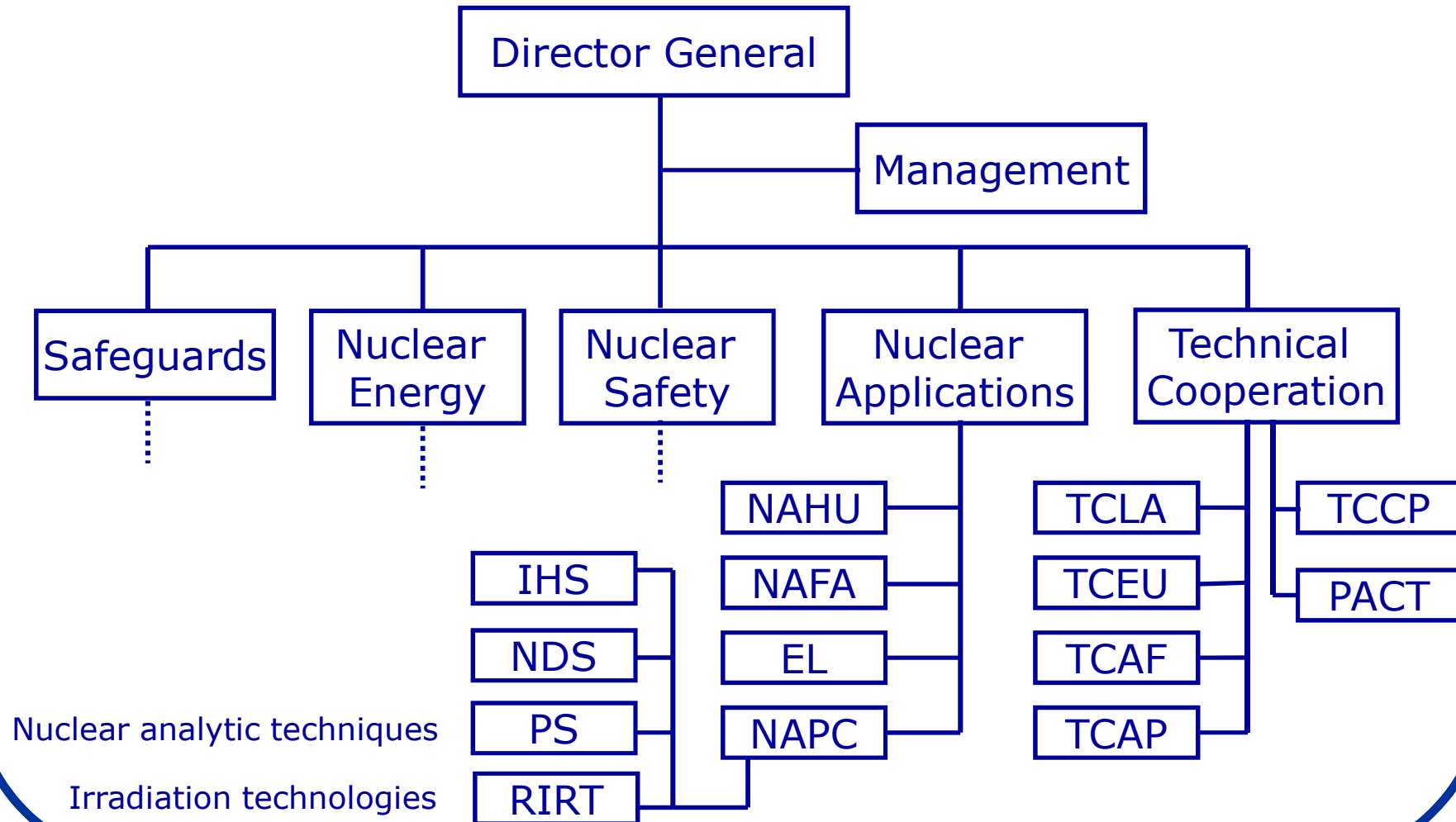
IAEA areas of work (main pillars):

- Nuclear Technology and Applications
- Nuclear Safety and Security
- Safeguards and verification

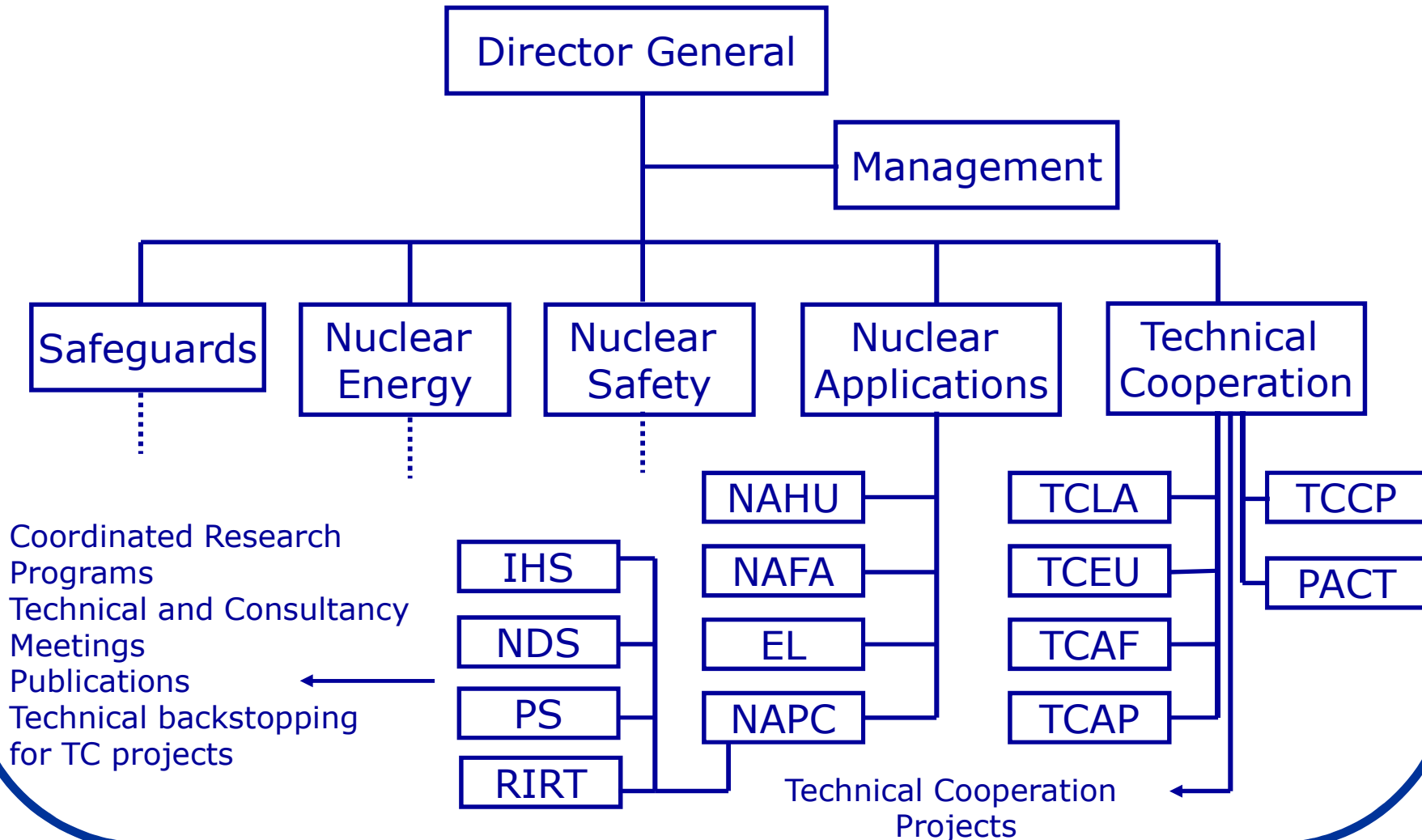
Main fields of nuclear technology and applications:

- Nuclear Technology and Applications
 - Energy
 - Health
 - Addressing environmental issues
 - Water
 - Food and agriculture
 - Industry
 - Nuclear Science

IAEA organizational structure



IAEA organizational structure



NAPC: Division of Nuclear Applications in Physics and Chemistry

Mission:

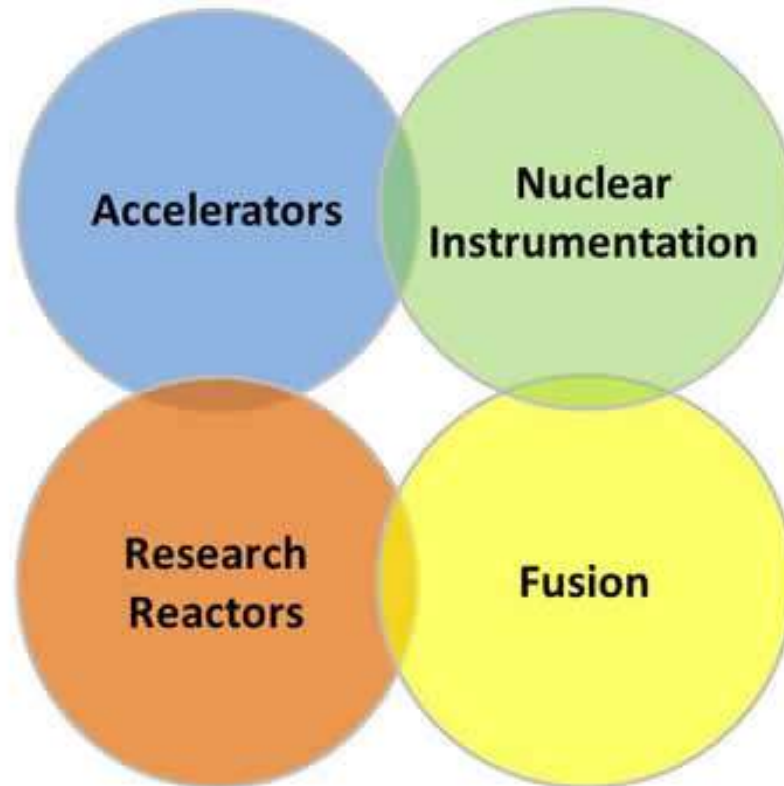
carrying out Agency activities to assist and advise Member States (MS) in assessing their needs for capacity building and research and development in the nuclear sciences, as well as in supporting the MS activities for deriving benefits in specific fields, including:

- Atomic, molecular and nuclear data
- Nuclear and radiation techniques, their applications and allied instrumentation
- Utilization of research reactors and particle accelerators
- Radioisotopes and radiopharmaceuticals
- Radiation processing applications
- Radiation technology and isotopic tracers for industrial processes
- Isotope hydrology and water resources management
- Nuclear fusion

PS: Physics Section

Mission:

Supports Member States with regard to the utilization of **particle accelerators**, **research reactors**, **applications of instrumentation** and **controlled nuclear fusion**



Regular Programme Projects (PS)

Major programme 1. Nuclear Power, Fuel Cycle and Nuclear Science

Programme 1.4 Nuclear Science

Sub-programme 1.4.2 Research Reactors

Project 1.4.2.1 Enhancement of utilization and applications of research reactors

Sub-programme 1.4.3 Accelerator Applications and Nuclear Instrumentation

Project 1.4.3.1 Fostering accelerator applications in multiple disciplines

Project 1.4.3.2 Facilitating experiments with accelerators

Project 1.4.3.3 Nuclear Instrumentation

NSIL: Nuclear Sciences and Instrumentation Laboratory

Spectrometry



Instrumentation

Mission: Assisting Member States in introducing and extending the use of nuclear instrumentation and radiation spectrometry techniques

- Training
- Research aimed to improve analytical performance and to extend applicability (Adaptive Research)
- Provision of analytical services (MS and other IAEA units)

NSIL: Analytical facilities

- Energy Dispersive XRF
 - 2 x Secondary Target Excitation (SPECTRO2000, EPSILON 5)
 - Direct/filtered x-ray tube excitation (MiniPAL3)
 - Micro-XRF and confocal-XRF setup (own development)
 - Transportable XRF (Collimated / micro-XRF, own development)
 - Handheld XRF (NITON XIt)
 - 2 x TXRF (Atominstitut, ATOMIKA)
 - FFXRF (under development)
- SEM-EDS (FEI)
- Transportable XRD (InXitu)
- Multipurpose HVC (GIXRF, XRR, XAS)
 - At ELETTRA Synchrotrone, Trieste
 - At Seibersdorf (for training)
- IBA end station (PIXE, RBS, at IRB, Zagreb, Croatia)

NSIL: Analytical facilities (future)

- ReNUAL (planned accelerator facility)
 - E-beam
 - Linear particle accelerator

<http://www-naweb.iaea.org/na/renewal/>

Final Architectural Rendering of the FML



Final Architectural Rendering of the IPCL



ReNuAL

Renovation of the Nuclear Applications Laboratories

RIRT: Radioisotopes and Radiation Technologies Section

Mission:

To improve Member State capabilities in the production and use of radioisotope products for supporting the management of cancer and other chronic diseases.

To promote worldwide availability of products and facilities needed to extend the benefits of radioisotope products and radiation technology to large segments of the population of developing Member States.

RIRT: Radioisotopes and Radiation Technologies Section

Provides capacity building in:

- Development, production and quality assurance of reactor and accelerator based medical isotopes and radiopharmaceuticals for both diagnosis and treatment of diseases, especially cancer.
- Setting up Cyclotron and radioisotope/radiopharmaceutical production facilities.
- Setting up irradiation facilities and using gamma radiation, electron beam and X-rays for varied applications such as tackling pollutants, wastewater treatment, sterilization of medical products, disinfestation of food grains, synthesis and characterization of advanced materials.
- Applications of radiation and isotopes in industrial process management as well as for preservation of cultural heritage artefacts.

Regular Programme Projects (RIRT)

Major programme 2. Nuclear Techniques for Development and Environmental Protection

Programme 2.5 Radioisotopes Production and Radiation Technology

Sub-programme 2.5.2 Radiation Technology Applications for Health Care and Cleaner Industrial Processes and Practices

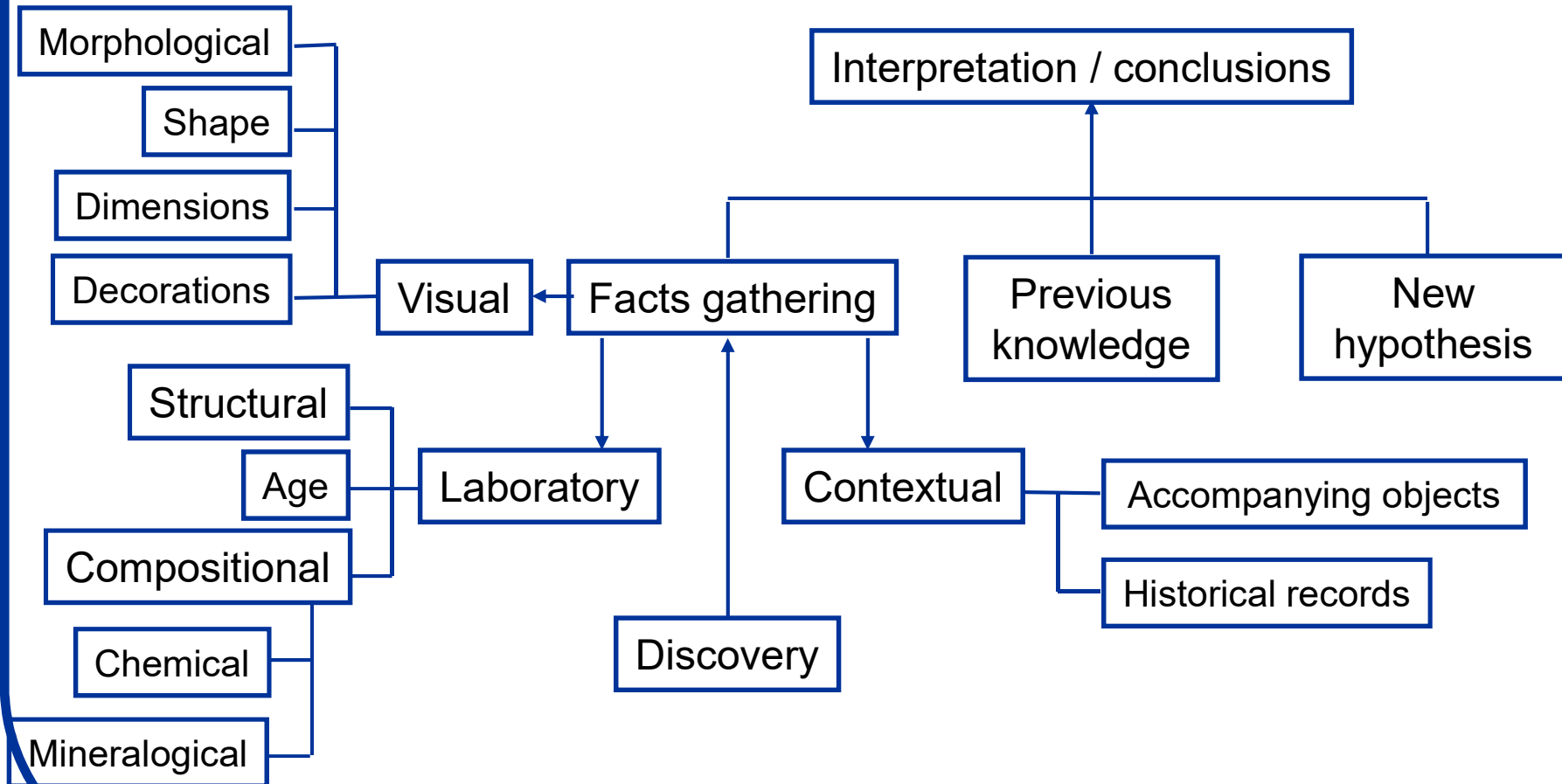
PROJECTS:

2.5.2.1 Industrial applications of radioisotopes and radiation techniques

Why to support CH studies?

- legacy of the past
 - powerful beacon of cultural identity
 - primarily composed of collectively owned goods
- A proper characterization, conservation and transmission of this legacy to future generations is a responsibility of the whole society

Object characterization implies, among other actions...



Which techniques are considered as “nuclear”?

- All the methods aimed to measure radioactivity, either natural or induced
 - α, γ - spectroscopy, β counting, counters, dose-meters
 - NAA, PGAA, PIGE
- Techniques based in using some type of ionizing radiation to induce some interactions in the inspected samples and the further measurement of a response signal related to a particular property of the sample
 - x- ray spectroscopy (SEM-EDS, PIXE, XRF)
 - IBA techniques (PIXE, PIGE, RBS, ERDA, IIC, etc)
 - Synchrotron based techniques
 - X and n radiography
 - Dating techniques (^{14}C , TLD, PLD)

Which nuclear techniques can be applied to CH?

Comprehensive characterization

Age

^{14}C , Thermo and Photo-Luminescence, K-Ar

Composition

Chemical

NAA, XRF, IBA, RBS, SEM-EDS, PIGE

Mineralogical

XRD, SEM-EDS

Structural

Micro scale: SEM-EDS, μ -XRF, μ -PIXE, FFXRF, GIXRF, XRR
Macro scale: X-ray radiography, x, n -tomography

Conservation

Radio-sterilization

Main advantages of nuclear techniques

- Applicable to a wide diapason of materials
- Non-destructive or minimal invasion/alteration of the sample
- Simple sample preparation (less contamination risks)
- In a number of cases, transportability to the object
- High selectivity and multi-elemental(compounds) capability
- Spatial resolution



IAEA activities

- Implemented under Regular Budget projects
 - Conceived from assessment of MSs needs/demands
 - Include:
 - Technical / Consultancy Meetings
 - Coordinated Research Programs
 - Publications
- Implemented under Technical Cooperation
 - Projects originate from MSs proposed concepts
 - Include:
 - National Projects
 - Regional Projects
 - Interregional

Meetings

- Consultancy Meetings
 - Bring together investigators to seek advice on technical insights of emerging, edge-cutting investigations in a particular field
 - Not announced publicly
 - Consultants are invited by technical sections, based on expertise
- Technical Meetings
 - To foster exchange of information on fields of applications that are of relevant interest for member states
 - Announced in IAEA website
 - Nomination by government is required
 - Limited funds available for support of participants from developing MSs

Technical Meetings are announced at...

<http://www-pub.iaea.org/iaeameetings/>

The screenshot displays the IAEA Meetings website interface. At the top, there are navigation tabs: "Who We Are", "What We Do", "Latest from IAEA", "Books & Reports", and "Specialized Resources". Below these is the main heading "IAEA Meetings in 2016" and a search bar labeled "Search IAEA Meetings:" with a "Search" button.

On the left side, there is a vertical menu under "Major Meetings" with the following items: "Meetings in 2017" (circled in red), "Meetings in 2016", "Meetings in 2015", and "Meetings in 2014". Below this is an "Archived Meetings" section with a "Select Year:" dropdown menu. Further down are "Other Meetings" and "Other Information" sections, including a link for "IAEA Meeting Schedule (PDF)" and "Vienna Public Transportation - Reduced Conference tickets*".

The central part of the page features a grid of three conference cards for 2016:

- CN-236**: International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally... (11 – 15 April 2016, Vienna, Austria)
- CN-238**: International Conference on Advancing the Global Implementation of Decommissioning and Environmental Remediation (23–27 May 2016, Madrid, Spain)
- CN-240**: Scientific Forum: Nuclear Technology for the Sustainable Development Goals... (28–29 September 2016, Vienna, Austria)

Below the grid is a section titled "Conferences and Symposia" with a link to the "International Conference on Human and Organizational Aspects of Assuring Nuclear Safety – Exploring 30 Years of Safety Culture" (23–26 February 2016, Vienna, Austria).

On the right side, there is a "Meetings - Quick View" section listing "Vienna, Austria, 21 – 25 November 2016" and "Vienna, Austria, 10 - 14 October 2016" for the "International Conference on Integrated Medical Imaging in Cardiovascular Diseases (IMIC 2016)" and "International Conference on Nuclear". Below this is an "IAEA RSS Feeds" section with links for "Meetings in 2016", "IAEA Books", and "IAEA Job Vacancies".

Coordinated Research

- Coordinated Research Projects

bring together research institutions from its developing and developed Member States to collaborate on research projects of common interest

- Initiated at Technical Divisions based on recommendations from previous Consultancy and Technical Meetings

Information on CRPs is available at

<http://cra.iaea.org/cra/index.html>

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Coordinated Research Activities

Uniting the World through Research

Coordinated Research Activities

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Stories

OPEN FOR NEW RESEARCH PROPOSALS: Over 50 New IAEA Coordinated Research Activities Now Open for Application.

2016-05-26 – Research institutes and organizations interested in gaining access to vast global databases of research findings and taking part in papers submitted to high-level, peer-reviewed journals, can now submit a proposal for a Research Contract or Agreement to take part in IAEA-coordinated research activities this year. [Read More](#) –

Information on CRPs is available at

Coordinated Research Activities

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Explore CRPs

All CRPs open for proposals

All active CRPs

All completed CRPs (last 5 years)

Advanced Search



Forms



CRA Information Letter

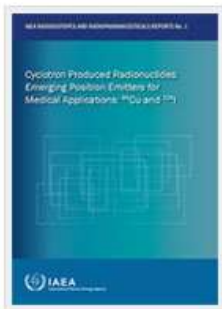
▶ Resources

Stories



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NEW PUBLICATION: Production and Utilisation of Emerging Positron Emitters for Medical Applications with an Emphasis on Cu-64 and I-124 (F22049)

2016-03-16 - This publication presents the achievements of the CRP. It provides a comprehensive overview of the technologies involved in the production of copper-64 and iodine-124, techniques on preparation of targets, irradiation of targets under high beam currents, target processing, target recovery and labelling. [Read More](#) —



NEW CRP: Mutation Breeding for Resistance to Striga Parasitic Weeds in Cereals for Food Security (D25005)

2016-01-18 - This Coordinated Research Project will support generation of novel sources of variation, using mutation breeding, by developing efficient screening protocols for Striga resistance in cereals for building research capacity and improving food security in Member States. [Read More](#) —

NEW CRP: Application of Nuclear and Genomic Tools to Enable for

take part in IAEA-coordinated research activities this year. [Read More](#) —

Completed Coordinated Research Projects

CRP Title:	Nuclear analytical techniques in archaeological investigations
Duration	1997-2000
Participating Countries:	Argentina(C), Brazil(C) (2), Chile(C), Cuba(C), Mexico(C), Peru(C), United States Of America(A)
Duration:	Start date: 1996-12-01 Closed date: 2000-12-14
Overall Objectives:	a) To promote interdisciplinary research between analytical chemists using nuclear analytical techniques and archaeologists in the Latin American region

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On-going Coordinated Research Projects

CRP Title:	Experiments with Synchrotron Radiation for Modern Environmental and Industrial Applications
Participants	Australia, Austria, Germany, India, Indonesia, <u>Italy</u> , Poland, Spain, Thailand, <u>United Arab Emirates</u> , United States of America
Duration:	2014 - 2018
Overall Objectives:	expanding and strengthening the research capacity of MS in multidisciplinary applications of synchrotron radiation based X-Ray Spectrometry (XRS) techniques (40% of the beam time has been granted to the IAEA, accessible to end-users by the second semester of 2014) GIXRF, TXRF, XRR, XAS

On-going Coordinated Research Projects

CRP Title: Developing Radiation Treatment Methodologies and New Resin Formulations for Consolidation And Preservation of Archived Materials and Cultural Heritage Artefacts

Participants Bangladesh, Brazil, Bulgaria, Croatia, Egypt, France, Iran - Islamic Republic of, Italy, Poland, Portugal, Romania, Tunisia, Turkey, Ukraine

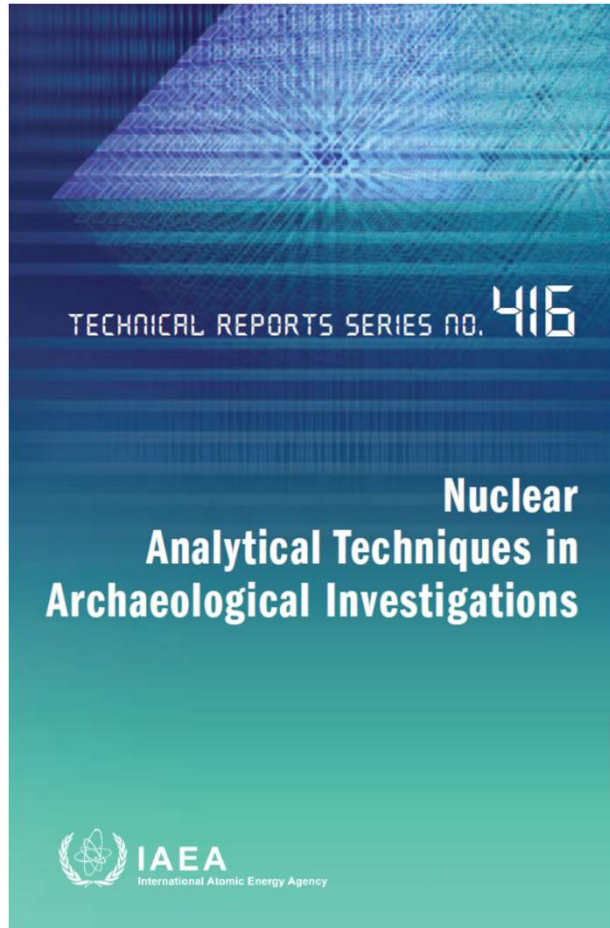
Duration: 2015 - 2019

Overall Objectives: Evaluating the effect of irradiation on the functional properties of such artefacts' base materials and minor constituents, as well as on post-irradiation effects and appropriate irradiation procedures for wider use of the technique

IAEA publications

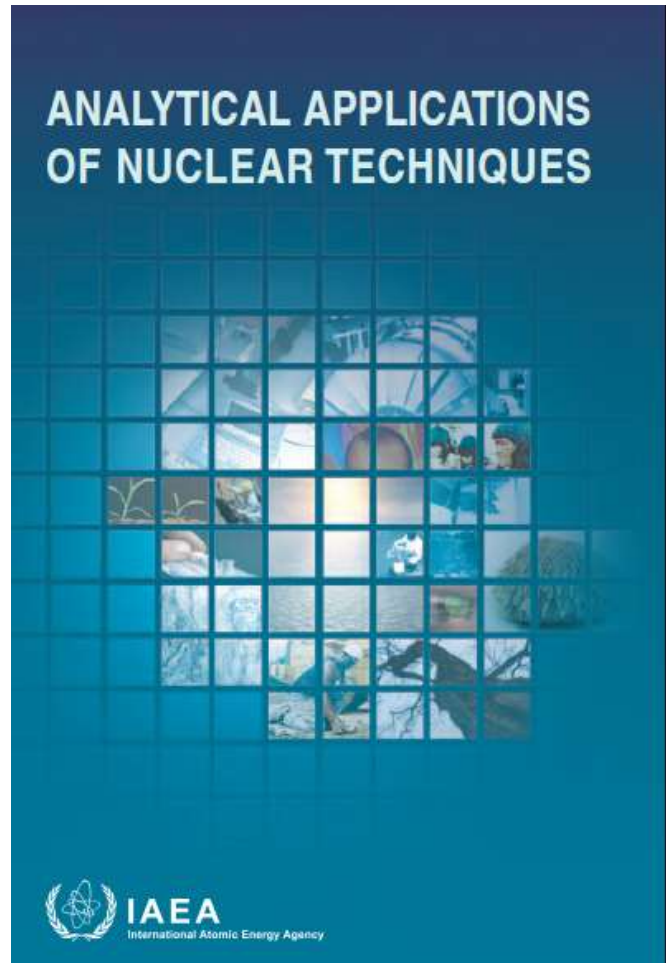
- Safety Standards
- Book series (technical)
- Nuclear energy series
- Nuclear Fusion Journal
- Conference proceedings
- Data publications
- Newsletters

IAEA publications related to CH studies



2003:
INAA method for ceramic paste
analysis
Multivariate analysis of results
COUNTRY REPORTS

IAEA publications relevant to CH studies



2004:

Part VI

Non-destructive testing of art objects

Part VIII

Archaeological investigations

IAEA publications relevant to CH studies

IAEA-TECDOC-1386

Emerging applications of radiation processing

*Proceedings of a technical meeting
held in Vienna, 28–30 April 2003*

2004:

- Role in sustainable development
- Prospect and developments
- Accelerator technology developments



INTERNATIONAL ATOMIC ENERGY AGENCY IAEA

January 2004

IAEA publications relevant to CH studies



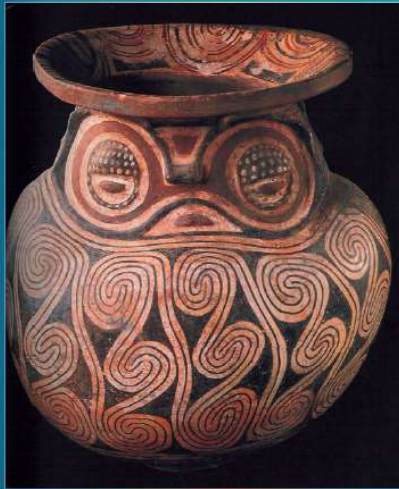
2005:

COUNTRY REPORTS

- Novel quantitative procedures for in-situ XRF (μ -XRF for cultural heritage)
- In-situ characterization of paint layers of large art and archaeological objects
- Optimization of portable systems for EDXRF analysis of paintings
- In-situ XRF elemental analysis of art and archaeological objects

IAEA publications related to CH studies

IAEA RADIATION TECHNOLOGY SERIES No. 2



Nuclear Techniques for
Cultural Heritage Research



2011:

PART I: OVERVIEW

CHAPTER 1. INTRODUCTION

- 1.1. Historical development
- 1.2. Conservation/restoration
- 1.3. Provenancing
- 1.4. Dating
- 1.5. Authenticity verification
- 1.6. Scope of the book

PART II: THE SCIENTIFIC METHODS USED IN CULTURAL HERITAGE RESEARCH

CHAPTER 2. CONSERVATION OF PAINTINGS

CHAPTER 3. PROVENANCING OF POTTERY

CHAPTER 4. DATING OF ARTEFACTS

CHAPTER 5. AUTHENTICITY VERIFICATION
OF JEWELLERY AND COINAGES

CHAPTER 6. NEW DEVELOPMENTS IN
NEUTRON RADIOGRAPHY

PART III: CASE STUDIES

IAEA publications relevant to CH studies

IAEA-TECDOC-1669

*Integration of
Nuclear Spectrometry Methods
as a New Approach to
Material Research*



IAEA

International Atomic Energy Agency

2011:

COUNTRY REPORTS

- Compositional correlation between pigments found in excavations and on human bones investigated with micro-Raman spectrometry and scanning electron microscopy
- Black pigments of rock art: identification of inorganic and organic components by combining analytical techniques
- Combined use of μ -XRF, μ -XAS and μ -XRD for microanalysis of environmental and cultural heritage materials in two and three dimensions
- Integration of analysis techniques of different scales using x-ray induced and electron induced x-ray spectrometry for applications in preventive conservation and environmental monitoring
- Analysis of pre-Columbian and contemporary gold alloys availing of EDXRF equipment

IAEA series relevant to CH studies



XRF Newsletter:

Contents:

- *Activities at SEIB XRF laboratory*
- *Technical Meetings and CRPs*
- *Conferences and Workshops*
- *Support to Regional TC Projects*
- *Announcements*
- *Publications of potential interest*
- *XRF at Member States*



Fig. 1. Presentation of the portable XRF spectrometer during an exhibition accompanying the 50th IAEA General Conference, Vienna, Austria, 18-22 September 2006.

www-pub.iaea.org/books/IAEABooks/View_Newsletters/109/XRF-Newsletter

IAEA series relevant to CH studies



XRF Newsletter:

Issues describing MSs facilities & applications:

- (2) BEL, HUN, POL; (3) SLO, SPA;
 (4) PER, SPA; (5, 6, 7, 8) SPA; (7) GRE;
 (9) ALB; (10) CUB, PER, SPA;
 (11) CRO, GRE, POL; (12) BEL;
 (13) SEIB, ITA, SPA; (14) ALB, CUB;
 (15) POR; (16) ARG, GRE, SPA;
 (17) SEIB, ITA; (18) BEL, POL, SPA;
 (19) ALB, ARG, PER, SPA;
 (20) PER, SPA; (21) SEIB, ITA; (22) SRB;
 (23) UAE; (24) THA; (25) ITA; (26) ITA

IAEA series relevant to CH studies

XRF Newsletter: Detailed info on CH applications

- (6) Collaborative "Bronze Art Project" (SEIB)
- (8) In-situ analysis of bronzes by PXRF (SEIB)
- (10) Transportable XRF spectrometer with poly-capillary optics and vacuum chamber (SEIB)
- (15) Non-destructive elemental characterization in art and cultural heritage research (POR)
- (18) Integration of analysis techniques of different scales using x ray induced and electron induced x-ray spectrometry for applications in preventive conservation and environmental monitoring
- (18) Compositional characterization of ancient coins by means of XRF instrumentation
- (21) NSAL 3D u-XRF for elemental imaging of paint layer composition in Roman period pplaster fragments
- (22) Micro-XRF analysis of metal alloys: Addressing the problem of micro-scale heterogeneity
- (25) Full Field XRF Imaging with High renerg abd spatial resolution (ITA)
- (26) Handheld XRF analysis of a 16th century Mexican Feather Headdress

Technical Cooperation

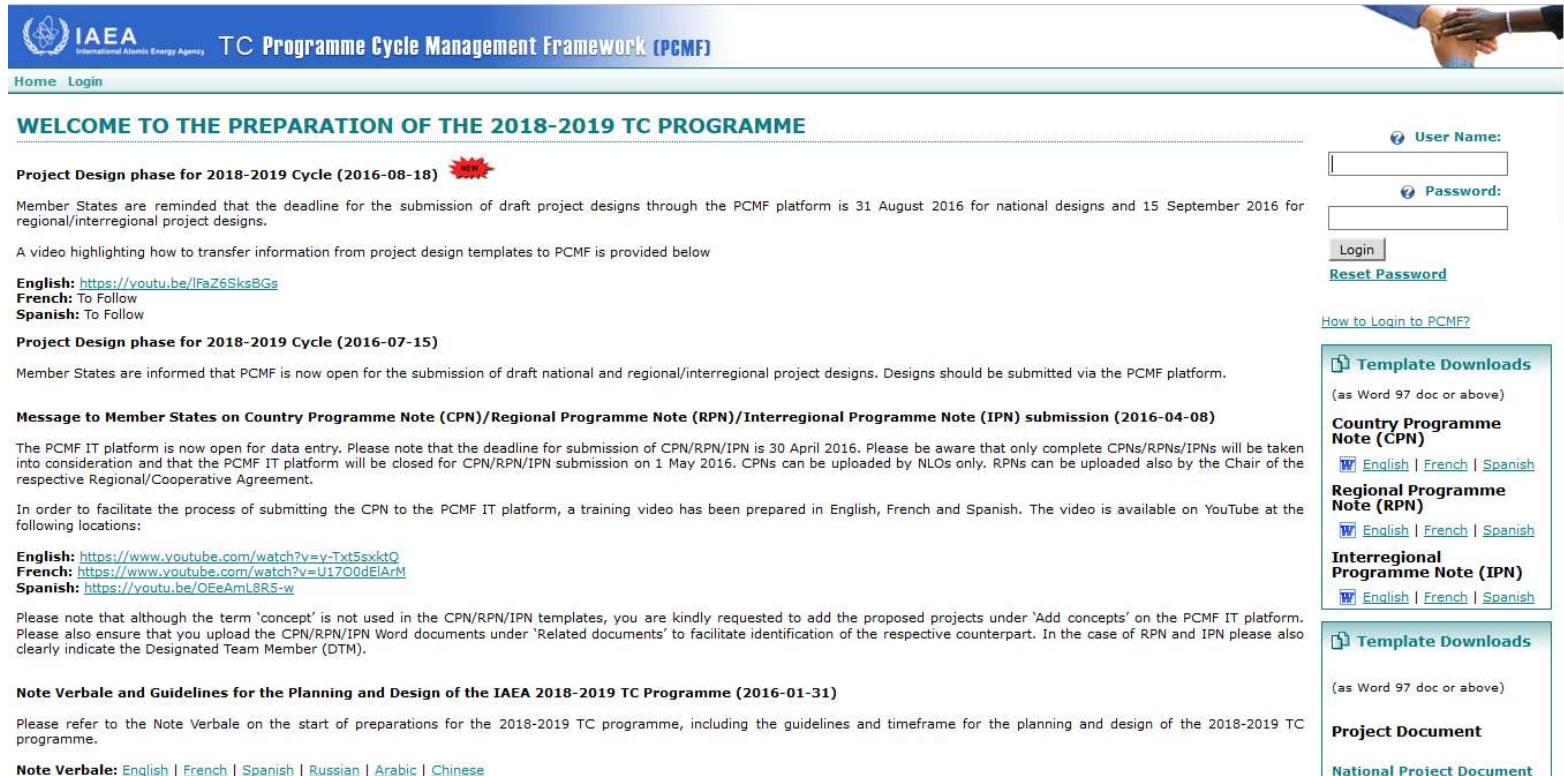
- Projects originate from MSs proposed concepts
 - National Projects
 - Any person can initiate a concept proposal
 - Prioritization set by national authorities
 - Number of national projects constrained by available funds
 - Aimed at introducing new techniques in support of solving a national need
 - Equipment
 - Human capacity building

Technical Cooperation

- Projects originate from MSs proposed concepts
 - Regional Projects
 - Concept proposals initiated by a DTM with support of other countries
 - Each participating team likely to represent the interest of a number of national institutions
 - Approved at Regional forum (ca. 200 – 400 kEur)
 - Aimed at fostering exchange of information
 - RTC
 - Provision of special materials and supplies
 - Harmonization of practices
 - Quality control

Proposal and design is made through web platform PCMF

<http://pcmf.iaea.org/>



The screenshot shows the PCMF website header with the IAEA logo and the title "TC Programme Cycle Management Framework (PCMF)". Below the header, there are navigation links for "Home" and "Login". The main content area is titled "WELCOME TO THE PREPARATION OF THE 2018-2019 TC PROGRAMME". It features several announcements, including "Project Design phase for 2018-2019 Cycle (2016-08-18)" with a "NEW" tag, and "Project Design phase for 2018-2019 Cycle (2016-07-15)". There are also links for "English", "French", and "Spanish" for various documents and videos. On the right side, there is a login form with fields for "User Name:" and "Password:", a "Login" button, and a "Reset Password" link. Below the login form, there are sections for "Template Downloads" for "Country Programme Note (CPN)", "Regional Programme Note (RPN)", and "Interregional Programme Note (IPN)", each with links for "English", "French", and "Spanish".

Registration: TC-Project-Team.Contact-Point@iaea.org.

Technical Cooperation Projects

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SYR1004: Dating Analysis and Preservation						MAK2005: Analysis and Preservation									LEB1009 Dating			
PER8013 : Analysis Conserv ation		CRO1005: Analysis and Preservation				UAE0006: XRF for Archaeol. Appl.									MAT1001 Capab. For CH			
						LEB1006: PIXE for Archaeol.												
				RLA8043 Databases		ALB2013: Conservation and Protection												
		RER1006: Protection CH Mediterranean				RER8015: Charact. & Preservation			RER0034 Charact. Preserv.	RER0039 Diversify ing		RLA0058 Cons & Preserv		RER1018 NDT		RLA		
				RAS1010 Acceler.		RAS1011: IBA									RAS1021 Preserv. Conserv.		RAS1023 IBA	

TC National Projects implemented

Code Year	Title	Objective
<u>TUR2007</u> 1982	Conservation of Archaeological Works	To support experiments on conservation of archeological works using radiation polymerization on the impregnating monomers)
<u>SYR1004</u> 2008	Nuclear Techniques for Dating Analysis and Preservation of Archaeological Materials	To promote and strengthen the use of the accelerator and miniature neutron source reactor (MNSR) facilities for dating and elemental composition analysis of archaeological artefacts.
<u>MAK2005</u> 2009	Establishing Nuclear Techniques for the Analysis and Preservation of National Cultural Heritage Objects	To improve national heritage conservation capabilities through establishing and making available to the restorers new techniques for characterization of the artefacts.

TC Regional Projects implemented

Code Year	Title Participants	Objective
RER0034 2012-2013	Enhancing the Characterization, Preservation and Protection of Cultural Heritage Artefacts ALB, AZB, BIH, BUL, CRO, CYP, GRE, HUN, LIT, MAT, MNE, MOL, POL, POR, ROM, SRB, SLO, TAD, TFYRM, TUR, UKR	To improve the characterisation, preservation, protection and authentication of cultural heritage artefacts by effective utilisation of nuclear analytical techniques and radiation technology
RER0039 2014-2015	Extending and Diversifying the Application of Nuclear Technology in Cultural Heritage ALB, ARM, AZB, BIH, BUL, CRO, CYP, GRE, HUN, KAZ, LAT, LIT, MAT, MNE, POL, POR, ROM, SRB, SLO, SLK, TAD, TFYRM, TUR, UKR	To enhance cultural heritage knowledge and its contribution to socioeconomic welfare

TC Regional Projects implemented

Code Year	Title Participants	Objective
RAS1010 2007-2010	Use of small accelerators as nuclear analytical tool in art and archaeology (ARASIA) IRQ, JOR, LEB, SAU, SYR, UAE	To support establishing the authenticity and provenance of objects of art and archaeology making use of Ion Beam Accelerators as nuclear analytical tool.
RAS1011 2009-2012	Using Ion Beam Analysis and Complementary Nuclear Techniques for Material Characterization in ARASIA State Parties IRQ, JOR, LEB, OMN, QAT, SAU, SYR, UAE, YEM	To enhance and promote the use of ion beam analysis and complementary nuclear techniques, such as X ray fluorescence, to study the characteristics of materials related to archaeology, and new elaborated materials. In some cases, samples related to environment will also be considered.
RAS1023 2018-2021	Harnessing Nuclear Science and Technology for the Preservation and Conservation of Cultural Heritage	To enhance the characterization, preservation and protection of cultural heritage artefacts

TC Regional Projects implemented

Code Year	Title Participants	Objective
RLA8043 2007-2010	Use of Nuclear Analysis Techniques and <u>Development of Databases</u> for Characterization and Preservation of National Cultural Heritage Objects (ARCAL XCIV) ARG, BRA, CHI, COS, CUB, ECU, MEX, PER	To contribute to the study and preservation of the national cultural heritage by providing analytical information for the characterization and contextualization of cultural heritage artefacts, through the collaborative use of facilities that are available for these purposes in Latin America
RLA0058 2016-2017	Utilización de técnicas nucleares en apoyo de la conservación y la preservación de los objetos de patrimonio cultural ARG, BOL, BRA, CHI, COS, CUB, DOM, ECU, MEX, PAN, PER, URU	Use of nuclear techniques in the field of CH promoted and harmonized in Latinamerica and the Caribbean region

TC Regional Projects planned

Code Year	Title Participants	Objective
RLA2018012 2020-2021	Using Nuclear and Radiation Technology to Characterize, Conserve and Preserve the Cultural Heritage of Latin America and the Caribbean	To use nuclear techniques / technologies efficiently to support cultural heritage preservation

TC Success stories

<https://www.iaea.org/technicalcooperation/Pub/Suc-stories/>
Presented at IAEA General Conference



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Atoms for Peace: The First Half
1957-2007



IAEA
Technical Cooperation Programme
September 2012

Protecting cultural heritage artefacts in the Mediterranean region

The challenge...
The Mediterranean countries have a rich cultural patrimony, with long periods and cultures. Nuclear techniques can play an important role in the study and conservation of cultural heritage, helping to determine the age, the technology of these objects. Such techniques can also verify authentic illegal trafficking, and provide information on the composition of only nuclear based techniques, such as X ray fluorescence spectroscopy works of art. Priceless pieces – from Callini's Sallera to Michelangelo analysed using these methods. As any movement to a work of art is catastrophic, the goal of art restorers is to minimize disturbance and portability and unobtrusive nature of XRF reduces the risk of damage being studied.

The project...
This project assisted existing laboratories using nuclear techniques in the field of cultural heritage activities and promoted the potential use of nuclear techniques in the study, restoration and protection of artefacts. A regional network of nuclear scientists and conservation professionals was established in order to share experience, knowledge and analytical capabilities.

The impact...
This project successfully advanced the interest and participation of conservation specialists, archaeologists, curators and nuclear scientists. It has promoted the application of nuclear techniques in the field of cultural heritage protection through organized regional training courses and workshops. Nuclear scientists and conservators were able to address ongoing related to the challenges of cultural heritage protection and conservators could understand how effective nuclear techniques can be in their work as artefact preservationists. The results of the project will extend into the future as cultural heritage artefact protection will be enhanced through nuclear analysis techniques.

IAEA develops

REPER/04 Nuclear Techniques for the Protection of Cultural Heritage Artefacts in the Mediterranean Region

Preserving cultural heritage artefacts in Latin America

The challenge...
Latin America's cultural heritage is one of the region's primary knowledge, and a powerful symbol of cultural identity. The restoration of objects requires scientific, technical and historical analytical techniques are used to identify the chemical composition for profile establishment and can also help with the fight against illegal trafficking of cultural goods. The documentation of this which allows detailed recording and cross-referencing is also

The project...
The project's main aim was to assist the participating countries (Argentina, Brazil, Chile, Costa Rica, Cuba, Ecuador, Mexico and Peru) with the study and preservation of their national cultural heritage, through the provision of analytical information for the characterization and contextualization of cultural heritage artefacts. Expertise was provided through workshops, training and expert missions on the use of nuclear analytical techniques. A database was developed for curators, researchers, archaeologists and other analysts, to support and promote the use of nuclear analytical techniques.

The impact...

- The database developed through the project is the first in the region to contain descriptive and analytical data on samples of archaeological and other cultural property, accessible to relevant users.
- Several laboratories in the region have successfully applied nuclear analytical techniques to study archaeological ceramics and samples of volcanic (volcanic rock) and brines.
- The nuclear techniques have been presented through publications, outreach seminars and talks aimed at representatives of institutions related to the study of cultural heritage.

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REPER/04 Use of Nuclear Analysis Techniques and Development of Characterization and Preservation of National Cultural Heritage Objects

Conserving cultural heritage artefacts in Croatia

The challenge...
As a Mediterranean country, Croatia has many archaeological sites with a vast number of historical objects that require in-depth research, conservation or restoration. Until recently, only a small number of objects were properly characterized before conservation work began. Insufficient characterization sometimes resulted in significant damage to these objects, as the procedures applied did not fully match the requirements for their restoration.

The project...
Obtaining very precise information on the chemical composition of an artefact is invaluable for proper conservation or restoration work. This project applied non-destructive analysis techniques, such as mobile X-ray fluorescence (XRF) spectrometry, to research the origins of the objects and determine how best to conserve or restore them. In specific cases, sensitive micro-analysis was required that relied on accelerator based techniques, such as external beam positron induced X-ray excitation (PPIX) and proton microprobe PIXE.

Quantifiable data...

- In the first year of XRF operation, more than 100 external beam PPIX was used in the first year artefacts made of different alloys (such as steel).
- Ion microbeam PIXE is now being used to analyze sections of joint tissues.

The impact...
The impact of high quality of conservation work is undoubted. It will be highly beneficial for the Croatian population and to visitors from abroad.

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CR/09/04 Nuclear Techniques for the Analysis and

Preserving Europe's cultural heritage for the benefit of future generations

The challenge...
Cultural heritage, or the artefacts and attributes of a group or society that are inherited from past generations and maintained for the future, includes objects such as buildings, monuments, books and paintings. Cultural heritage is a driver for tourism and is important to the economic competitiveness of Member States in the European region. However, environmental threats driven by climate change, including acidification, air pollution and erosion, are placing Europe's cultural heritage in danger. In addition, many artefacts are not stored under the right conditions; they may become infected with biological contaminants that can destroy them. The sustainable management and preservation of Europe's unique and irreplaceable cultural resources is a key challenge for the region.

The project...
Through a regional technical cooperation (TC) project, the IAEA provided training to specialists from nuclear science and conservation institutions in the region on the application and integration of different nuclear techniques for characterization and preservation of cultural heritage artefacts. With the aim of enhancing and transferring technical knowledge and skills, the project offered participants unique networking opportunities, encouraging cooperation and creating synergies. Targeted expert guidance, tools and reference materials were provided to support the study of cultural heritage artefacts, including conservation, restoration, provenancing, dating and authenticity verification. The project helped to optimize irradiation and analytical techniques in the region and establish harmonized methodologies.



Conservators and scientists examining XVI century wall paintings from the church of Saint Mary, Gachnitsa, Berat, Albania.

The impact...
The regional TC project triggered a significant increase in the number and types of cultural heritage artefacts analysed and treated in all 18 participating Member States. Procedures ranged from the disinfection of wooden churches and ancient books in Romania, to the characterization of jewellery (by X-ray fluorescence), woven cloth and coins housed at the Shirvanshah Palace in Azerbaijan. Collaboration between nuclear specialists and conservators was consolidated at the national and regional levels and the basis was laid for partnerships with strategic national and international partners, such as UNESCO. Overall, the project was an important step towards the sustainable management of cultural heritage artefacts in Europe, contributing to enhanced cultural tourism and accelerated socioeconomic development in the region. The cross-stakeholder and cross-sectoral nature of the project is an example of 'good practice' within the TC programme.

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Technical cooperation project RER/016: Using Nuclear Techniques for the Characterization and Preservation of Cultural Heritage Artefacts in the European Region

2008: Europe

2009: LA

2010: Croatia

2012: Europe

Concluding remarks

- IAEA has dedicated considerable resources to foster the use of nuclear techniques in the effective preservation of cultural heritage objects.
- Regional cooperation allows effective exchange of knowledge and harmonization in performance, as well as provides a framework to foster access to different facilities could enhance the regional capabilities
- National TC projects is a convenient strategy to strengthen analytical infrastructure
- Participants are encouraged to approach IAEA requesting the organization of dedicated Workshops, Technical meetings and CRPs

Acknowledgements

- Local authorities and organizers.

Thanks for your time and attention...