

Protecting Romania's cultural heritage using nuclear technology

By Aabha Dixit

“Radiation doesn’t damage the precious artefacts; they don’t become radioactive, and it’s swift and effective.”

—Valentin Moise, Director, IRASM Radiation Processing Centre, Bucharest, Romania

Preserving art and cultural heritage is a shared ambition of the global community. The past plays an important role in understanding a people’s way of life, which is why Father Ioan from an Orthodox church in the village of Izvoarele on the southern slopes of the Carpathian mountains in Romania was desperate to save the revered 19th century assembly of icons of his parish. Faced with a dreadful situation when he noticed insects inside his church, Father Ioan turned for help to a very unlikely source — radiation treatment — to prevent any further parasite attacks.

National Institute of Physics and Nuclear Engineering.

The traditional approach to eradicate insects, such as woodworm, is to inject poison either in the form of a gas or liquid into each hole created by the insect and seal it with wax. The poison should reach the area in which the insect subsists and multiplies; however, the insects are often not fully eradicated. Chemical treatment is a long and expensive process that also exposes people to hazardous fumes. In comparison, radiation treatment requires a shorter treatment time, is inexpensive and completely eliminates the insects.



Gamma radiation was used to eradicate the insects that were destroying the iconostasis in the 19th century Holy Voivode of Michael and Gabriel Church in Izvoarele village. Following the irradiation treatment, local artisans worked to restore this precious piece of art to its full glory.

(Photo: A. Socolov/Horia Hulubei National Institute of Physics and Nuclear Engineering)

Woodworms were nibbling away at the sacred work of art, known as an iconostasis, in this old church in the picturesque hamlet of 800 homes, 120 kilometres north of Bucharest. “It was my responsibility to take action. At the beginning, I started to inject chemical solutions in the insect holes. Because the icons are thick objects, the injection solution did not penetrate deep to the source of the worm attack and there was no effect. That is why I considered a better solution,” said Father Ioan.

He took the insect-infested iconostasis to the IRASM Radiation Processing Centre in Bucharest, where staff welcomed him with awe. “He heard about us on television. He arrived alone at our door, with no phone call in advance,” said Valentin Moise, Director of the Centre, which is part of the Horia Hulubei

Romania is among the 18 IAEA Member States that have received support to enhance irradiation and analytical techniques in Europe through IAEA projects. The support has triggered a significant increase in the number and types of cultural heritage artefacts analysed and treated, said Sunil Sabharwal, a radiation processing specialist in the IAEA. Procedures ranged from the disinfection of wooden churches and ancient books to the characterization of jewellery, woven cloth and coins. Cooperation in the characterization and preservation of artefacts through the use of nuclear science and technology is an important goal of the IAEA’s cultural heritage preservation projects, Sabharwal said.

Relics versus fungi, insects and bacteria

To preserve its historical antiquities, Romanian scientists regularly use gamma rays to treat artefacts. Stored in a six metre deep water pool at the IRASM Radiation Processing Centre in Bucharest, the source of powerful gamma rays, when activated, can kill bacteria, insects and fungi (see box). Gamma radiation works wonders to conserve artefacts by destroying the “biological aggressors,” explained Moise.

Radiation is being increasingly used for preservation. “Protecting our cultural heritage

goes back to 30 years ago when there were no large scale irradiation facilities in Romania,” said Moise. “We have through this technology been able to disinfest a number of ancient items from 500 year old religious books infested with fungi to the precious icons of the Izvoarele Orthodox Church.”

Before the artefacts are irradiated, investigations are carried out on these delicate pieces of history that determine the extent and kind of contamination, the chemical solutions used in previous restoration efforts, as well as the exact radiation dose required, Moise explained.

“One of the biggest problems we have had was to convince the art world that radiation will not destroy artefacts as the technology used is harmless. There is confusion when they hear the word radiation,” said Moise. “It doesn’t damage the precious artefacts; they don’t become radioactive, and it’s swift and effective.”

Paintings, clothes and musical instruments have also been successfully treated using gamma radiation. IRASM experts treated the entire collection of the Theodor Aman Museum in Bucharest, which had to be closed in 2004 due to damp conditions that resulted in fungi and other biological contamination of its ancient objects. Following complete refurbishment, the museum was reopened in 2013.

“Many artefacts are made from natural organic materials. They are at risk of biodegradation, becoming food for insects and microorganisms,” said Corneliu Ponta,



Above: A degraded insect infested wooden iconostasis in the 20th century Spring of Healing Church, in Izvoarele village, was irradiated using gamma radiation prior to local art restorers undertaking repair work.

(Photo: C. Ponta/Horia Hulubei National Institute of Physics and Nuclear Engineering)



Left: A damaged wooden icon that belonged to a collection of 33 wooden icons that was sent for irradiation treatment to IRASM Radiation Processing Centre from the Moldova National Museum Complex.

(Photo: Moldova National Museum Complex)

the former Head of the IRASM Radiation Processing Centre, who played a key role in the Centre’s work in using gamma irradiation to decontaminate the artefacts of the Theodor Aman Museum.

THE SCIENCE

Gamma radiation protects cultural artefacts

Gamma radiation, also known as gamma rays, refers to electromagnetic radiation of an extremely high frequency. It is emitted as high energy photons, an elementary particle with wave-like properties.

Gamma rays are a type of ionizing radiation. At the dose levels used to protect cultural artefacts, this type of ionizing radiation inhibits reproduction of microbes at room temperature without any physical contact and thus offers a better alternative to conventional decontamination methods that are based

on heat or chemical treatment. The high frequency, high energy electromagnetic waves interact with the critical components of cells. And at these dose levels, they can alter the DNA so as to inhibit the reproduction of cells.

The treatment of cultural artefacts by irradiation technology is similar to that used in the sterilization of medical devices. The cultural heritage artefacts are exposed to gamma radiation from a cobalt-60 source in the radiation facility.