

Nuclear Applications: the role of the International Atomic Energy Agency to peace and global development.

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Nuclear science and technology is present everywhere in our daily lives and many still may not recognise the widespread application of the peaceful uses of nuclear technology. The IAEA plays an important role in confronting both emerging and longer term global challenges through the peaceful application of nuclear technology.

The IAEA is currently celebrating its 60th anniversary but the origins actually began in Japan, a decade earlier, in August 1945, when the destructive horror of nuclear weapons was so vividly and tragically demonstrated. In the years immediately following World War II, there was increasing concern as additional countries mastered, or were working to master, the technology to develop such weapons. During the same post-war period, however-on a parallel track, the peaceful use of nuclear science was coming to be seen as a futuristic, "high-tech" field, one that held great promise of transforming the way we live. Technologies with great potential to save lives, reduce suffering, and advance economic development. The pressing issue was how to further develop and promote these peaceful applications, while at the same time prevent the spread of weapons technology. That was-and some may say-still is- the 'nuclear dilemma'. Against this backdrop, the US President Eisenhower made a speech in 1953, in which he proposed the creation of an International Atomic Energy Agency. This was his proposal to solve the nuclear dilemma. Four years later, in the spirit of 'Atoms for Peace', the IAEA was created.

The IAEA under its 1957 mandate is not only mandated to safeguard technology against potential proliferation but also to facilitate the use of peaceful technology to meet development challenges. Today, 60 years later, it is still the first pillar of the IAEA statute that offers the majority of its developing Member States the clearest and most immediate impetus to engage with the Agency. The IAEA is known for the work it does in safeguards but another important part of the IAEA work is the assistance it provides countries in the peaceful application of nuclear technology. This is as important to the IAEA as its non-proliferation work. Nuclear non-proliferation and development go hand in hand. Predominantly, the IAEA has been seen as a nuclear watchdog but over the last couple of years, the narrative has evolved and areas of prioritisation includes, the improvement of cancer treatment and facilities in developing countries; the use of nuclear technology to generate affordable and clean energy as countries work to meet their commitments under the Paris Agreement on climate change; improve human and animal health; increase food production; and contribute to climate change.

Whilst the IAEA continues to be the centre for cooperation in the nuclear field and preserving the key importance of nuclear safety and security; it is increasingly in the peaceful application of nuclear science and development that the IAEA has been making strides. Increasingly, the IAEA assists countries in developing new food crops that are resistant to drought, enables them to develop a better understanding of ocean acidification and enables them to use nuclear techniques to manage limited water resources.

Food and Agriculture

With respect to food and agriculture, the IAEA and the Food and Agriculture Organisation, through the Joint FAO/IAEA Division focus on the appropriate use of nuclear technologies in food and agriculture, contributing to global food security and sustainable agricultural development. The IAEA assists farmers to increase food supplies by developing new varieties of crops such as rice and barley which are more resistant to drought and disease, and higher-yielding. Scientists accelerate the spontaneous mutation breeding by applying radiation in the laboratory which allows them to develop new varieties of crop very quickly. Other areas of support using nuclear technologies include the control of insect pests such as the Mediterranean fruit fly and Tsetse fly through the Sterile Insect Technique, which is a major area of research and applied technology in many countries globally.

Environment

Nuclear techniques and isotopes are also utilised to monitor and understand environmental challenges, including tracking the global consumption by oceans of carbon dioxide leading to ocean acidification. The IAEA laboratories in Austria and Monaco have supported Member States in this regard. Scientific monitoring has revealed the negative impact of ocean acidification on fragile marine eco-systems. These impacts endanger food supply for coastal and island communities.

Water Resources

The IAEA, through its water resources programme supports countries to undertake isotopic analysis of water to accurately assess the age, origin and evolution of groundwater resources, as well as its quality and risk of contamination. Determining the age of an aquifer and how quickly it is being replenished is crucial to estimate how much water can be sustainably withdrawn from potentially fragile systems. The IAEA provides assistance and training via the Isotope Hydrology Laboratory that assists countries to improve the availability and sustainability of freshwater resources through science based, comprehensive water resources assessments.

Human Health

An important focus of the work of the IAEA is in the area of human health, and in particular, cancer control. With the increase in non-communicable diseases (NCDs), nuclear technology continues to play a critical role in treatment and assessment of disease. The support provided through the IAEA in this area is vital to providing access to treatments to many communities, which previously did not have the capacity to apply such technologies in the fight against

NCDs. Cancer treatment can often include radiotherapy through gamma rays, electrons and charged particles (protons and carbon ions). These treatments involve significant investments in infrastructure and equipment as well as training for qualified professionals to man these departments and supervise quality assurance protocols. The IAEA is working closely with partners such as the World Health Organisation in this regard. The IAEA has also developed innovative e-learning initiatives which offer specialised training for health professionals in areas such as radiotherapy, medical physics and nutrition.

Industrial Applications

The industrial applications of nuclear technology are far reaching and a whole range of new 'greener' industrial applications are contributing to sustainable development and production of high quality products while the wealth of data accumulated through nuclear spectrometry and accelerator science is leading to further developments in the peaceful and beneficial applications of nuclear technology.

Clean Energy

Nuclear power is one of the best known peaceful applications of nuclear technology. At present, 30 countries use nuclear power whilst many more countries, especially in the developing world, are exploring the possibility of introducing it. Nuclear power makes a significant contribution to reducing greenhouse gas emissions and improving energy security, while delivering energy in the growing quantities needed for development. The IAEA does not prescribe or influence countries to use nuclear power but it does assist countries that are interested, to use it safely, securely and sustainably. Nuclear safety and security are national responsibilities but the IAEA serves as the forum for international cooperation in these areas.

The way forward

The IAEA has always maintained a reputation for technical proficiency and effectiveness and as Membership of the IAEA continues to grow and demand for services in all areas of nuclear sciences and applications increase, the IAEA through its coordinated research activities will continue to coordinate and encourage research in selected nuclear fields by scientists which will foster the exchange of scientific and technical information needed to address the ever increasing needs of today's world.