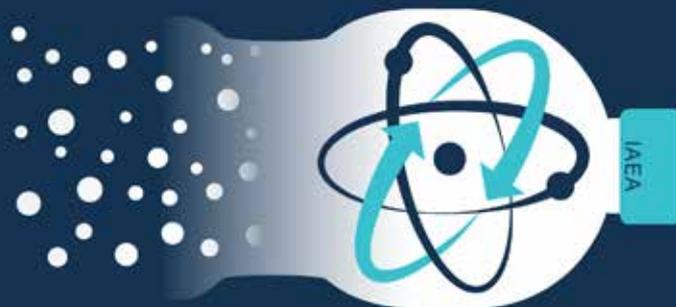


# SUMMARY REPORT



## **NUTEC Plastics** A nuclear solution to plastic pollution

# **ROUNDTABLE**

FOR EUROPE AND CENTRAL ASIA

7 October 2021, Vienna, Austria



**IAEA**

International Atomic Energy Agency



The sea as seen through a discarded plastic bottle by the beach. (Photo: Karu vadography/Pixabay)

# NUTEC Plastics Roundtable

FOR EUROPE AND CENTRAL ASIA

## Contents

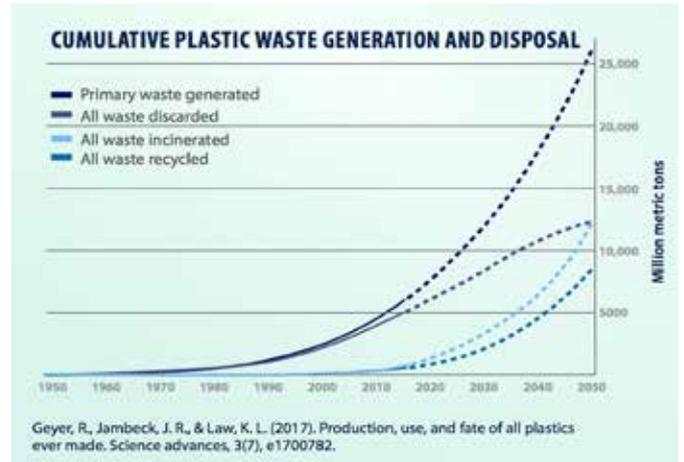
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<b>Background on NUTEC Plastics</b>	<b>4</b>
Towards a circular economy	4
Radiation technology in plastic waste recycling	5
Protecting the ocean	5
Global partnership needed	6
<b>Summary of the NUTEC Plastics Roundtable for Europe and Central Asia</b>	<b>7</b>
<b>Introduction</b>	<b>9</b>
IAEA NUTEC Plastics: A nuclear solution to plastic pollution	9
Why the IAEA?	10
NUTEC Plastics Roundtable for Europe and Central Asia	11
<b>Proceedings of the Roundtable</b>	<b>12</b>
Session One: Plastic Pollution ‘Challenges and the Need for Global Action’	12
Session Two: Partnerships for Sustainable Solutions to Plastic Pollution	22
Closing remarks	31
<b>Agenda of the Roundtable for Europe and Central Asia</b>	<b>35</b>

# Background on NUTEC Plastics

Following current trends, the ocean is expected to contain one tonne of plastic for every three tonnes of fish by 2025, and by 2050, there will be more plastic than fish.<sup>1</sup> Approximately 70% of all plastics produced to date is now waste and of this only 9% has been recycled. In many places, plastic waste is mismanaged and ends up in unregulated landfills or open dumps from where it enters the ocean.<sup>2</sup>

Plastic waste pollution not only has adverse effects on the ocean, but also on terrestrial environments such as soil and groundwater. Even as waste, plastic does not decompose due to its durability and longevity. When it reaches the ocean it can remain there for hundreds of years, and over time it fragments and turns into micro- and nano-plastic. The problem of plastic pollution is increasingly receiving global attention, but gaps in addressing the problem remain due to the lack of sufficient awareness, knowledge, technology, financing and effective policy.



**70%** of all plastics produced to date is now waste.

**Only 9%** is being recycled globally

## Towards a circular economy

The linear model of producing, using and disposing plastic is unsustainable. A global approach is needed that establishes a circular economy and focuses on the ‘4Rs’: reduce, reuse, recycle and renew. Analysis and evidence show that nuclear applications can complement existing technologies and thus accelerate the transition towards a circular economy for plastics.

However, the potential contribution of nuclear science and technology for addressing the plastic waste problem is not well known, and hence is rarely integrated into proposals for sustainable, scalable solutions. A change is needed to increase the knowledge and awareness of these techniques and technologies. More importantly, they need to be applied more broadly in practice in order



to use the full potential of nuclear techniques in reducing the global plastic waste burden. For this to happen, and based on its previous and existing work, the IAEA has developed NUTEC Plastics to assist IAEA Member States in integrating nuclear techniques in their efforts to address challenges of plastic pollution – making IAEA’s

1 World Economic Forum, ELLEN MacARTHUR Foundation, MCKINSEY Center for Business and Environment, *The New Plastics Economy – Rethinking the Future of Plastics*, WEF, Cologne (2016).  
 2 GEYER, R., JAMBECK, J.R., LAW, K.L., *Production, use, and fate of all plastics ever made*, *Sci. Adv.*, (2017).

contribution to solving this global problem more apparent and perceptible. The IAEA supports research and uptake of nuclear techniques in two main areas: monitoring and assessment of marine plastics and plastic/polymer waste recycling and upcycling.

## Radiation technology in plastic waste recycling

Radiation technology for industrial purposes, such as gamma and electron beams, offers unique advantages for reducing plastic and polymer waste and therefore fills existing technological gaps in dealing with such waste. Irradiation can address sorting challenges experienced by mainstream mechanical recycling methods by enabling effective sorting of plastic wastes to feed into recycling streams, thus improving the quality and value of the recycled plastics.

Radiation technologies can be used to transform or recycle plastic waste into other products, such as fillers and binders for construction materials. They can also be used to break down or convert waste plastic polymers into smaller components, fuel or monomers to generate chemical feedstocks to produce consumer products, with or without the addition of virgin polymers. Reduction of plastic waste is also possible by replacing petroleum-based plastics with biodegradable biopolymers obtained through radiation-driven processes.

Furthermore, radiation technology offers cleaner production and recycling processes, thus reducing the use of potentially harmful additives and solvents, as well as delivering energy savings.

NUTEC Plastics will integrate radiation technologies for plastic waste recycling into national, regional and global initiatives. Ongoing laboratory-scale activities



Radiation technology can help in the effective sorting of plastic wastes thus improving the value of the recycled plastics. (Photo: D. Jekic/123rf)

are paving the way for pilot plastic recycling plants to establish the volume, energy and financial balances associated with using radiation technologies to recycling various plastic wastes. Based on the proof of principle and experience gained from the pilot(s), the technology will be scaled-up to a large-scale plastic waste recycling demonstration plant(s).<sup>3</sup>

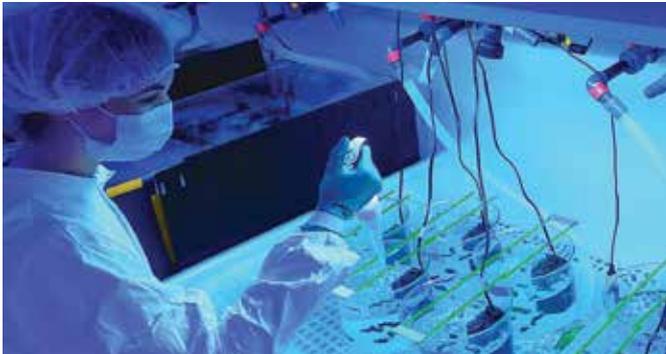
## Protecting the ocean

The ocean is the final repository of mismanaged and unrecycled land-based plastics, and there is a lack of sufficient knowledge and understanding of the abundance and impact of microplastics in the ocean. More accurate data are needed to assess the effect that microplastics and associated contaminants have on marine organisms that are part of the global food chain, such as food for human consumption, and therefore on seafood exports, food safety and human health. Isotopic



Photo: R. Quevenco

<sup>3</sup> IAEA Brochure: NUclear TEChnology for Controlling Plastic Pollution (2021).



Researchers at the IAEA Marine Environment Laboratories model realistic scenarios to examine how and to what extent microplastics can transfer contaminants to marine organisms and eventually to humans. (Photo: F. Oberhaensli and H. Jacob/IAEA)

techniques offer unparalleled precision and complement conventional techniques in tracking the abundance and distribution of nano- and micro-plastics in the marine environment.

Isotopic tracers, imaging techniques and gamma and beta counters have unique abilities to assess the impacts of micro- and nano-plastics on marine biota. These techniques provide important markers for studying the toxicity of plastics on living organisms, to reveal in detail the impacted organs and systems, and allow to trace the actual toxicological stress and their possible propagation in food chains that can ultimately impact humans through consumption of seafood.

NUTEC Plastics will strengthen and scale up the development of reliable and cost-effective techniques to assess the spatial and temporal abundance and character of marine plastics to better understand their origin, transport mechanisms, as well as fate and impact. This includes the establishment of harmonized, standardized protocols to identify microplastics in environmental samples, analytical techniques that are in line with best practices and state-of-the-art science, and training for scientists and technicians in their use.

## Global partnership needed

A holistic and sustainable solution to the global plastic burden requires an integrated and comprehensive

approach that can only be achieved in partnership with organizations that have complementary roles and expertise. Working within existing national, regional and international initiatives, including private-public partnerships is essential. This includes collaboration with United Nation entities, multilateral development banks, philanthropies, existing large scale initiatives and multi-stakeholder platforms, private sector, and scientific and research institutions. The private sector will be a critically important partner in making the transition to a circular plastic economy, underpinned by strong governmental action and ownership through enabling policies and supportive legal environment.

NUTEC Plastics' two main components – monitoring and assessment and plastic recycling – are logically intertwined as both represent a contribution to the solution of the global plastic pollution problem. However, implementation of the two components is not contingent on each other.

Taking this connected but not co-dependent relationship into account, NUTEC Plastics adopts a modular approach. This approach offers the advantage of facilitating the implementation of certain activities according to resource availability, while offering Member States and partners the opportunity to engage in activities linked to their profile, preferences and priorities.

This approach offers the advantage of facilitating the implementation of certain activities according to resource availability, while offering Member States and partners the opportunity to engage in activities linked to their profile, preferences and priorities.



Photo: A. Koch/Pixabay

## Summary of the NUTEC Plastics Roundtable for Europe and Central Asia



The NUTEC Plastics Roundtable for Europe and Central Asia, 'Atoms Contributing to the Search for Solutions to Plastic Pollution,' was organized to provide a platform for presenting and discussing new solutions to address global plastic pollution, with a particular focus on the unique contributions of nuclear technologies and the promotion of partnerships for an integrated, coordinated and solution-oriented approach in the global fight against plastic pollution. As a result, new partnerships for NUTEC Plastics were established and ideas for cooperation in Europe and Central Asia were outlined.

The Roundtable was the fourth in a series of similar events that provide a platform to discuss ongoing efforts, innovative solutions and partnerships to confront plastic pollution from a regional perspective.

IAEA staff, along with researchers and scientists from the region shared their knowledge of, and expertise in technologies for recycling plastic waste and monitoring

marine plastic pollution. They also exchanged information on existing programmes and practices to explore partnership opportunities.

The Roundtable event highlighted how plastic pollution adversely affects the marine environment, the food chain and, ultimately, human health. Participants also learned how the plastic pollution problem hinders the achievement of many Sustainable Development Goals (SDGs). Discussions highlighted the urgent need to move away from the common use of plastic today, and from the linear 'take-make-waste' model, towards a sustainable circular economy for plastics built on the 4R principles: reduce, reuse, recycle and renew.

Participants heard about various initiatives, programmes and projects launched at national levels, and by international and regional institutions in Europe and Central Asia to apply sustainable solutions to plastic pollution. Furthermore, speakers at the Roundtable

emphasized the critical role of science, technology, innovation and partnerships in addressing the issue.

Through NUTEC Plastics, the IAEA supports and contributes to these global, regional and national responses. NUTEC Plastics builds on the IAEA’s efforts to deal with plastic pollution through its portfolio of existing and planned research projects and activities. IAEA technical cooperation projects help to strengthen the recycling process using radiation technology and marine microplastic monitoring with the use of isotopic tracing techniques.

In summary, the Roundtable presented activities under NUTEC Plastics that will support the continuing development of new solutions to address plastic pollution, with a particular focus on the unique contributions of nuclear technology. It highlighted the need to strengthen partnerships for an integrated, coordinated and solution-oriented approach to tackling plastic pollution.

### Roundtable Participants



**386** total attendees  
62 IAEA + 324 external participants



**56** countries represented



**10** international/regional organizations



**23** panelists  
internal and external senior level officials



**2** roundtable sessions

### Attendance Per Country

Albania	3	Latvia	22
Armenia	1	Lithuania	5
Austria	107	Malaysia	5
Azerbaijan	2	Mexico	1
Belarus	1	Monaco	8
Belgium	5	Montenegro	1
Bosnia and Herzegovina	2	Netherlands	3
Bulgaria	1	Nigeria	2
China	1	Norway	26
Croatia	6	Pakistan	1
Cyprus	2	Philippines	1
Czech Republic	21	Poland	3
Estonia	8	Portugal	4
Ethiopia	1	Romania	8
Finland	1	Russian Federation	4
France	22	Senegal	1
Georgia	6	Serbia	17
Germany	7	Slovakia	1
Greece	7	Slovenia	4
Hong Kong	1	Spain	2
Hungary	4	Sri Lanka	4
Iceland	1	Sweden	7
Indonesia	1	Switzerland	4
Ireland	1	Thailand	2
Italy	9	Türkiye	3
Kazakhstan	2	United Kingdom	4
Kenya	1	United States	2
Kyrgyzstan	10	Uzbekistan	7
<b>Total</b> (including 23 external panelists)			<b>386</b>

### Attendance Per Affiliation

Government	25
Industry	16
International Organizations	10
IAEA	62
National Nuclear Institutions	94
Permanent Missions	51
Research Institutions	56
Unspecified	72
<b>Total registrations</b> (including 23 external panelists)	<b>386</b>

## Introduction



Plastic is one of the world's most used materials and plays an indispensable role in modern life. It has multiple functions and many benefits, but at the same time managing its disposal has become a rapidly growing global challenge. The first global analysis of the production, use and fate of plastics, conducted in 2017, estimated that over 70% of all plastic ever produced is now waste – 6.3 billion metric tonnes out of a total of 8.3 billion metric tonnes – and that only 9% has ever been recycled<sup>1</sup>.

Plastic pollution has become a pressing environmental issue in Europe and Central Asia, with more than 26 million tonnes of plastic waste generated every year. Rates of plastic waste landfilling and incineration are high, posing an environmental threat to ecosystems such as rivers, groundwater and the ocean. Plastic is by design durable and this longevity means that once it enters the ocean, it can remain there for hundreds of years. Over time it fragments and becomes micro and nano plastic, which can enter living organisms and the food chain. It is estimated that around 80% of marine litter is plastic<sup>2</sup>.

The vast quantities of plastic produced and discarded in Europe and Central Asia are harming ecosystems and natural resources and have an impact on biodiversity, food safety and human health<sup>3</sup>. Plastic pollution is an environmental and human health problem, and it also has a significant socioeconomic impact – for example, on the tourism sector. Plastic pollution requires a long-term, sustainable and economically feasible solution that moves away from the linear 'take-make-waste' model to a circular plastic economy.

### IAEA NUTEC Plastics: A nuclear solution to plastic pollution

The application of tailored nuclear techniques offers unique science-based solutions to plastic pollution. NUclear TEChnology for Controlling Plastic Pollution (NUTEC Plastics) aims to assist Member States to address the challenges of plastic pollution through two distinct applications: marine monitoring using isotopic tracing techniques and recycling using radiation technology. NUTEC Plastics is based on the latest

1 GEYER, R., JAMBECK, J.R., LAW, K.L., Production, use, and fate of all plastics ever made, *Sci. Adv.*, 3 7 (2017).

2 [https://ec.europa.eu/environment/topics/plastics\\_en](https://ec.europa.eu/environment/topics/plastics_en)

3 BARRA, R., LEONARD, S.A., *Plastics and the Circular Economy*, Scientific and Technical Advisory Panel to the Global Environment Facility, Washington, DC (2018).

## NUTEC Plastics...

... builds on a portfolio of IAEA research and technical cooperation projects in plastic recycling using radiation technology, and in marine monitoring of microplastics via isotopic tracing techniques. With NUTEC Plastics, the IAEA seeks to engage and expand dialogue with Member States, partners, industry and civil society. It provides a vision for the solutions that the IAEA offers to support better management of plastic waste. Implementation of activities will take place through established IAEA delivery modalities, such as technical cooperation and coordinated research projects and other programmatic activities.

technical, scientific, and economic knowledge of the plastic value chain and the transition towards a circular economy for plastic. It highlights the solutions that the IAEA offers to better manage plastic waste and seeks to engage and expand the dialogue on plastic waste solutions with Member States, partners, industry, and civil society. By applying nuclear techniques for controlling plastic pollution, the IAEA supports Member States in Europe and Central Asia in their efforts to achieve the Sustainable Development Goals (SDGs) and targets.

## Why the IAEA?

The IAEA's mandate is to accelerate and enlarge the contribution of nuclear science and technology for peaceful uses. The IAEA is the global hub for the development and transfer of nuclear technologies and applications and operates environmental laboratories in Austria and Monaco. The laboratories have an established track record of conducting applied research

and development (R&D), providing training and analytical services, and transferring proven nuclear techniques to Member States. The IAEA also undertakes R&D activities through its extended research networks with Collaborating Centres, consisting of research institutions, academia and laboratories around the world, and through its coordinated research projects (CRPs). Through its technical cooperation (TC) programme, the IAEA helps countries to build capacities in radiation technology and marine monitoring. Through these programmes and activities, the IAEA is supporting Member States in monitoring and assessing plastics in the marine environment, and in efforts to recycle plastic/polymer waste using irradiation.

There are currently over 40 planned and ongoing national and regional TC projects related to radiation technologies and environmental monitoring associated with the ocean. In Europe and Central Asia, 18 countries are working together to enhance coastal management in the Aral Sea, the Black Sea, the Caspian Sea and the Mediterranean Sea. Their marine laboratories are receiving IAEA support to develop analytical capabilities for monitoring and assessing environmental pollution, including microplastics. The aim is for the laboratories to share information and coordinate a regional response to address marine pollution.<sup>4</sup> In collaboration with the IAEA, Member States are developing capacities to safely apply gamma and electron beam radiation technologies in the industrial and environmental sectors, and to assess the feasibility of plastic waste recycling using radiation technologies.

<sup>4</sup> TC project RER7015 'Enhancing Coastal Management in the Mediterranean, the Black Sea, the Caspian Sea and the Aral Sea by Using Nuclear Analytical Techniques' (2020-2023)

## NUTEC Plastics Roundtable for Europe and Central Asia

With the view of increasing the visibility of NUTEC Plastics among Member States and partners, a NUTEC Plastics Roundtable for Europe and Central Asia was organized on 7 October 2021, bringing together high-level decision makers and stakeholders to discuss challenges, initiatives and opportunities for further collaboration to better manage plastic pollution in the region. The Roundtable aimed to increase awareness of plastic pollution initiatives and to promote the application of nuclear techniques in addressing this problem, with the ultimate goal of paving the way to the establishment of partnerships in the region.

The Roundtable consisted of two sessions. The first session addressed the challenges and the need for global action, and was chaired by IAEA Director General, Rafael Mariano Grossi. Ministers and Deputy Ministers, Heads of environmental agencies, and key representatives from foundations, the private sector, financial institutions and international organizations highlighted their policies and activities related to tackling plastic pollution. The second session focused on technical solutions, including R&D, to address this urgent problem, and was chaired by Ms Najat Mokhtar, IAEA Deputy Director General and Head of the Department of Nuclear Sciences and Applications. Researchers and scientists presented available nuclear technologies for plastic waste recycling and marine plastic monitoring and exchanged information on existing programmes and practices. The session was closed by Mr Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation.



NUTEC Plastics Roundtable for Europe and Central Asia” was organized by the IAEA on 7 October 2021. (Photo: D. Calma/IAEA)

# Proceedings of the Roundtable

## Session One

### Plastic Pollution: Challenges and the Need for Global Action

#### Opening Remarks



Ms Eve-Küllü Kala, IAEA Director, Division for Europe, Department of Technical Cooperation

Ms Eve-Küllü Kala opened Session 1 by welcoming the participants, panellists and speakers to the fourth regional NUTEC Roundtable to address plastic pollution using nuclear technology. She noted that no country can face the challenge of plastic pollution alone and stated that enhanced regional and global cooperation is needed now more than ever before. The IAEA is contributing to finding solutions to this problem with the launch of NUTEC Plastics, an initiative that aims to assist Member States in integrating nuclear techniques into efforts to manage plastic waste and increase circularity.

Ms Kala introduced the set-up of the Roundtable, which comprised two Sessions chaired by Director General Rafael Mariano Grossi (Session 1) and Deputy Director General and Head of the Department of Nuclear Sciences and Applications, Ms Najat Mokhtar (Session 2), as well as a wrap up of the event by Deputy Director General

and Head of the Department of Technical Cooperation, Mr Hua Liu. Ms Kala also welcomed the distinguished high-level panellists of the first session – the Minister of Ecology and Natural Resources of Azerbaijan, the Vice-Prime Minister and Minister of Environmental Protection and Agriculture of Georgia, the Minister for Maritime Affairs of Portugal, the European Commissioner for Environment, Oceans and Fisheries, the Deputy Minister of Development and Investment of Greece, the Deputy Minister of Environment of Estonia, the Director General of the National Energy Authority of Iceland, the Director of the Swedish Marine Management Department at the Swedish Agency for Marine and Water Management, as well as a World Bank representative, the Vice President of the Prince Albert II Foundation, and the Vice-President of Grieg Star, a Norwegian shipping company – all well-known for their policies and innovative activities in addressing plastic pollution.

## Opening Statement by Mr Rafael Mariano Grossi, Director General, IAEA



IAEA Director General Rafael Mariano Grossi addressing the Roundtable event. (Photos: D. Calma/IAEA)

Director General Grossi opened Session 1 by highlighting that plastic pollution is one of the major issues of this century, and that it greatly affects the environment. Noting that nuclear techniques and applications can contribute significantly to addressing plastic pollution, Mr Grossi pointed out, however, that it is important to take into consideration the context in different parts of the world because the nature of the problem, the industrial profiles and the social behaviours that drive plastic pollution are different. He said that figures on plastic recycling at the global level (around 9%) and in the European region (around 30%) are far from ideal, and that further commitment and work are required.

Mr Grossi stated that the added value of nuclear techniques deployed at the IAEA is that it enables stakeholders to work effectively on two levels – on the one hand, detecting and identifying plastic and microplastic presence in water and, on the other hand, recycling plastic in a more environmentally friendly way using irradiation. He acknowledged important ongoing efforts on this matter in the region and stated that the Agency does not aim “to reinvent the wheel.” Rather, it aims to be an effective partner that helps countries address plastic pollution in a faster, cheaper, and more effective way through the NUTEC Plastics initiative.

Mr Grossi announced that the Government of Sweden recently made a generous financial contribution to NUTEC Plastics and that others are planning to support the effort as well, an intention which he highly encouraged. He acknowledged the EU strategy on plastic pollution and welcomed further discussion on this issue with EU counterparts in the near future. Mr Grossi noted that in 2022, Portugal, together with Kenya, will co-host the UN Ocean Conference in Lisbon to propel much needed science-based innovative solutions for global ocean action. Finally, he informed participants that the IAEA is sensitizing the G20 on this topic and that the Agency will work towards consolidating all these efforts.

***“Global problems need global solutions and we can only solve big issues when we come together.”***

— Rafael Mariano Grossi, IAEA Director General

## Keynote Address by Mr Peter Thomson (UN Secretary General's Special Envoy for the Ocean)



Participants at the Roundtable watching Mr Thomson's keynote speech. (Photo: D. Calma/IAEA)

In his speech, Mr Thomson emphasized the deteriorating health of the ocean and stated that, if efforts were not concerted, by 2050 there would be more plastic in the ocean than fish. He praised the Governments of Ecuador, Germany, Ghana, and Vietnam for convening a Ministerial meeting of interested parties in September 2021 in Geneva that resulted in a draft resolution to commence negotiations on an internationally binding Treaty to stop marine plastic pollution.

Mr Thomson confirmed that using nuclear technology to control plastic pollution is an intriguing approach to the problem and applauded the Agency for its vision. He further expressed gratitude that the NUTEC Plastics Roundtable for Europe and Central Asia would explore opportunities for cooperation and partnerships, including resource sharing and resource mobilization. He also emphasized that together we can overcome the plague of plastic pollution. In concluding his remarks, Mr Thomson referred to the UN Ocean Conference scheduled for 2022 in Lisbon, noting that it will focus on marine pollution and the implementation of SDG 14.

***“To get Sustainable Blue Economy, we have much work to do, much to mitigate, much climate adaptation to invest in, and acting on the moral logic of intergenerational justice.”***

— Peter Thomson, UNSG's Special Envoy for the Ocean

# Roundtable Discussion

Mr Grossi chaired the first session of the Roundtable. The distinguished panellists discussed topics such as national and regional initiatives to tackle plastic pollution, opportunities for partnership building and resource mobilization, synergies between the public and the private sectors, as well as gaps in policy and regulatory frameworks that can be addressed through cooperation at regional and international levels. High-level speakers, including ministers and representatives of governmental agencies and the private sector, shared views and best practices on how to tackle plastic pollution and adapt to a more sustainable economic model based on circularity.

*“Better monitoring will help us understand origins and pathways, the scale of the problem and the impact on nature. What we can’t measure, we can’t manage. Without harmonized monitoring, we won’t have efficient measures to prevent and mitigate plastic pollution”*

— Virginijus Sinkevicius,  
European Commissioner for Environment,  
Oceans and Fisheries

## Session One Panelists



HE Mr Mukhtar Babayev,  
Minister of Ecology and Natural  
Resources of Azerbaijan



HE Mr Levan Davitashvili, Vice-Prime  
Minister and Minister of Environment  
Protection and Agriculture of Georgia



HE Mr Ricardo Serrão Santos,  
Minister of Maritime Affairs of Portugal



Mr Virginijus Sinkevicius, European  
Commissioner for Environment, Oceans  
and Fisheries, Directorate-General for  
Maritime Affairs and Fisheries,  
European Commission



HE Mr Meelis Münt, Deputy Minister  
of the Ministry of Environment of the  
Republic of Estonia



HE Mr Christos Dimas, Deputy Minister  
for Research and Technology, Ministry  
of Development and Investments  
of the Hellenic Republic.



Ms Halla Brund Logadóttir,  
Director-General, National Energy  
Authority of Iceland



Mr Mats Svensson, Director, Swedish  
Marine Management Department,  
Swedish Agency for Marine and Water  
Management (on behalf of Mr Jakob  
Granit, Director-General)



Mr Olivier Wenden, Vice President and  
Chief Executive Officer,  
Prince Albert II of Monaco Foundation



Ms Eli K. Vassenden, Vice President  
Shared Services, Grieg Star, Norway



Ms Bérengère Prince, Lead Natural  
Resources Management Specialist,  
World Bank Group



**HE Mr Mukhtar Babayev, Minister of Ecology and Natural Resources of Azerbaijan**, expressed appreciation to the IAEA for organizing the Roundtable. Mr Babayev shared that Azerbaijan, a producer and user of plastic materials, makes every effort to minimize its negative impact by strengthening environmental policy, including with regards to recycling and the broader production of biodegradable plastics. Relevant changes to the national legislation have also been made to reduce the negative impact of plastic waste on the environment.

Mr Babayev highlighted that the use of polyethylene bags under 15 microns and single-use plastic has been banned in Azerbaijan since 2021. Being a coastal state, Azerbaijan pays special attention to combating plastic pollution and marine litter in the sea. Mr Babayev expressed the hope that NUTEC Plastics would enable more accurate monitoring of plastic concentration in the environment and further implementation of recovery measures.



**HE Mr Levan Davitashvili, Vice-Prime Minister and Minister of Environmental Protection and Agriculture of Georgia**, acknowledged that the IAEA remains one of the leaders in identifying challenges of global importance while also playing a decisive role in finding solutions to tackle them. On behalf of the Government of Georgia, Mr Davitashvili commended the IAEA's NUTEC Plastics initiative and pointed out that, since Georgia is a coastal State, the country knows how plastic pollution adversely affects the marine environment, the food chain and, ultimately, human health.

Georgia has taken steps towards improving national capacities and the legislative framework, such as adopting the National Strategy on Waste Management. Moreover, the Georgian market has been open only for biodegradable and compostable plastic bags since 2019 and the government is currently finalizing a national plastic prevention programme with the support of Norway. Georgia is also in the process of adopting a new Extended Producer Responsibility regulation on packaging materials, and the most efficient system that has been identified is the introduction of monetary incentives for individuals to collect plastic from nature. In concluding, Mr Davitashvili noted that the Regulatory Body of Georgia will benefit from support of the IAEA to expand regulatory functions and technical or human resources to deal with any new application of nuclear techniques at the national level.



**HE Mr Ricardo Serrão Santos, Minister of Maritime Affairs of Portugal**, stressed that marine litter, in particular discarded plastics, are found in increasing volumes in marine and coastal ecosystems all over the world. Mr Serrão Santos informed that on the seafloor, there are 70 kg of plastics per square kilometre. Mr Serrão Santos shared that he belongs to the generation that has first seen the massive consumption of goods wrapped up in plastic and the inflation of take-away food and single-use plastics. The lack of proper regulations and a precautionary approach transformed a great technological innovation – plastic – into a huge environmental problem. As it is now clear that marine litter is a transboundary problem, he stressed that we must work on not only downstream – reducing the impact of plastic pollution on the ocean and its living community – but also upstream, preventing plastics from being discarded into the environment.

The EU adopted a new directive on single-use plastics that has been transposed into Portuguese law in a timely way, which shows that change, albeit not easy, is possible. The technical work carried out by UNEP and its resolutions to reduce marine litter pollution have provided clear evidence that existing national, regional, and international frameworks are too fragmented to tackle the problem.

Mr Serrão Santos pointed out that an instrument that takes into consideration the specificity of different countries is needed, but, at the same time, it should set

objectives, targets and measures to facilitate cooperation at international and regional levels. Finally, he welcomed the IAEA's efforts to develop nuclear technology for controlling plastic pollution.



**Mr Virginijus Sinkevičius, European Commissioner for Environment, Oceans and Fisheries, Directorate-General for Maritime Affairs and Fisheries, European Commission**, stated that marine litter is a matter of life and death for birds and mammals and comes at high costs for tourism and fisheries; hence, there is an urgent need for immediate action. He stressed that the EU is taking action: it has laws to protect the marine and coastal environment, rules for waste, wastewater management, and for the delivery of waste in ports, and it has adopted the Single-Use Plastic Directive which also applies to fishing gear.

Mr Sinkevičius pointed out that monitoring plastic would help to understand the origins, pathways, and the scale of the problem, as well as the impacts on nature. He stated that without harmonized monitoring there can be no efficient measures to prevent and mitigate plastic pollution. Mr Sinkevičius emphasized a need for innovation in plastic recycling and acknowledged the roundtable's focus on isotope technologies for monitoring and radiation technologies for recycling.

The EU is looking closely into chemical recycling in addition to mechanical recycling. However, the EU considers that technologies with a lower environmental

footprint that, at the same time, produce high quality recycled materials should be favoured. These are technologies that are also economically viable and that represent the technologies of the future. He concluded by emphasizing the need for a global shift to a more circular economy, mentioning that a global agreement to address plastic pollution is on the horizon.



**HE Mr Meelis Münt, Secretary General of the Ministry of Environment of the Republic of Estonia,**

shared that Estonia has adopted a National Action Plan to address marine litter and plastic pollution and cooperates on this matter with neighbouring countries in the Baltic Sea region and other EU Member States. He offered the example of Tallinn University of Technology, which participates in the CLAIM Technologies (Cleaning Litter by Developing & Applying Innovative Methods in European Seas) project to advance knowledge on marine plastic pollution and develop innovative technologies to reduce the amount and impact of plastic pollution in the Mediterranean and Baltic Seas. Mr Münt informed that CLAIM is engaging the wider public and generating much-needed changes in policy and public perceptions.

Because there is no clear record of how much litter ends up in the sea, Estonia has established a regular national marine litter monitoring system, which includes monitoring of both macro and micro litter. Smaller pieces of litter are much more difficult to trace and measure. Mr Münt appreciated the work by the Agency's scientists

at the laboratories in Monaco and noted that using nuclear techniques to better understand the movement of microplastic particles would give decision makers valuable information for more precisely targeted activities and measures to be taken.

In concluding, Mr Münt shared that Estonia is willing and ready to contribute and work together with all stakeholders interested in finding solutions to plastic pollution and recycling and with those who have an open mind to conduct R&D on new technologies.



**HE Mr Christos Dimas, Deputy Minister for Research and Technology, Ministry of Development and Investments of Greece,**

stated his country's support of the safe use of nuclear technology, recognizing its usefulness in dealing with challenges in areas beyond energy production, such as health, nutrition, water, and environment. He noted that in January 2018, the European Commission adopted the Strategy for plastics to change the way plastic products are designed, produced, used and recycled in the European Union. Moreover, Directive 2019/904/EU was issued to prevent and reduce the impact of certain plastic products on the environment, especially in the aquatic environment and human health. He emphasized that Greece completed the harmonization of the Directive into national legislation.

Apart from participating in relevant IAEA regional projects on this issue, Mr Dimas informed that in 2012, Greece

ratified a high-level instrument called a Long-Term Agreement (LTA). With this LTA the Greek Atomic Energy Commission is recognized as an IAEA Regional Training Centre in Europe. In concluding, he said that Greece welcomed NUTEC Plastics, which is expected to assist Member States efficiently and effectively in their efforts to address the challenges posed by plastic pollution.

includes 59 strategic actions that are categorized in eight thematic areas. In concluding, Ms Logadóttir stressed the importance of converting this political momentum into action – for the Arctic and the rest of the world.



**Ms Halla Hrund Logadóttir, Director-General, National Energy Authority of Iceland**, stated that high concentrations of microplastic particles have been detected in Arctic ice. Given the relatively small human population in the area, some research suggests the bulk of plastic pollution in the Arctic may not be generated locally and instead is carried there by currents from the Atlantic and Pacific Ocean, showing that it is a global challenge. Ms Logadóttir pointed out that plastic pollution could harm a still relatively pristine Arctic environment and local economies by deterring regional tourism, and damage the livelihoods of local fishers and hunters who have relied on a healthy marine ecosystem for centuries.

In 2019, the Arctic Council, a regional intergovernmental forum, identified plastic pollution as one of its top issues to address, and Ms Logadóttir noted that Iceland’s chairmanship spearheaded the first Action Plan to address plastic pollution. The plan was formally approved in Reykjavík by the eight Foreign Ministers of the Arctic States, including the Russian Federation and the United States, and is a significant regional milestone in this area. It



**Mr Mats Svensson, Director, Department for Marine Management, Swedish Agency for Marine and Water Management (SwAM)**, shared that the SwAMs tasked by the Swedish Government to protect, restore and ensure sustainable use of freshwater resources and the seas, including fisheries management. As a result of circulation currents in the North Sea, the Swedish west coast is heavily affected by marine litter floating ashore, thus, marine litter is of concern for Sweden nationally, regionally and globally. The SwAM is actively involved in regional work against marine litter in the Baltic Sea and the North East Atlantic.

Through the Regional Seas Conventions, the Baltic Marine Environment Protection Commission (HELCOM), and the Oslo/Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), Sweden is developing and implementing regional monitoring and assessment programmes for marine litter, including microplastics. In both Conventions, they are updating their environmental strategies and regional action plans for marine litter and are strongly committed to implementing measures addressing the sources in order to prevent and reduce marine litter from both land and sea. In concluding, Mr Svensson stated that

work within the EU and the Regional Seas Conventions (RSCs) are great examples of efforts supporting multiple regional and global commitments such as SDG 14, and emphasized that prevention is key to success in reducing marine litter.

a toolkit for companies to address plastic issues in other regions in the world. To conclude, Mr Wenden stressed the importance of the multi-stakeholder approach to tackling this issue and expressed gratitude to the NUTEC Plastics initiative of the IAEA.



**Mr Olivier Wenden, Vice President and Chief Executive Officer, Prince Albert II of Monaco Foundation**, highlighted that in the Mediterranean region, over 229 000 tonnes of plastic waste are dumped into the sea every year – the equivalent of 500 containers per day – with a disastrous impact on marine animals, the food chain, and human beings. The Prince Albert II of Monaco Foundation collaborated with the Tara Ocean Foundation, Surfrider Foundation Europe, the MAVA Foundation and International Union for Conservation of Nature (IUCN) and launched the initiative Beyond Plastic Med (BeMed) in 2015.

BeMed tackles plastic pollution by focusing on the origin of the problem and preventing plastics from reaching rivers, lakes, and seas. For the last five years, BeMed has already invested over €1.3 million in preventing plastic pollution in the Mediterranean. To increase its impact, BeMed has also embarked on initiatives with the private sector, creating a Business College in January 2020. To date, the College works together with 12 multinational companies, including Nestlé, Chanel, Veolia, Carrefour and InterContinental. Furthermore, to accelerate the transition toward single-use plastic-free industries, the Foundation has developed



**Ms Eli K. Vassenden, Vice President Shared Services, Grieg Star, Norway**, shared that the Grieg Group derives from a long and proud maritime tradition established back in 1884. The Group has a clear sustainability strategy to restore the ocean and adopt technology and knowledge-sharing to drive a change both in business and the societies in which they operate. The Group is owned 75% by the Grieg family and 25% by the Grieg Foundation, meaning that 25% of the profits go back to society.

Ms Vassenden pointed out that they work on plastic pollution from different perspectives and with various partners. The focus is to reduce plastic pollution from their industries. The Grieg Star works with World Wildlife Fund (WWF) in the Philippines, signing the international business call for an international treaty on plastic pollution. From a shipping perspective, Ms Vassenden stated that Grieg Star considers the international regulations to a large extent sufficient. However, as the shoreside creates the main risk for plastic ending back into the sea, Ms Vassenden urged a reduction of risk and a focus on collecting what is already in the sea through treaties and joint efforts.



**Ms Bérengère Prince, Lead Natural Resources Management Specialist, World Bank Group,**

presented the World Bank Group’s work in addressing plastic pollution at every stage of the plastics value chain. The Bank currently has US \$1 billion of ongoing projects in solid waste management and other activities that prevent plastic pollution and a further US \$2 billion in the pipeline. Ms Prince mentioned that this includes supporting governments via investments in solid waste management, advisory services on policies that create incentives to make recycling markets more sustainable and inclusive, and supporting governments and the private sector with innovative financing instruments.

The World Bank Group is working with China to strengthen policies that will reduce plastic pollution from municipal solid waste and manufacturing and agricultural practices. Ms Prince shared other examples of working in Asia to help curb plastic pollution in the region. For example, the International Finance Corporation’s US \$300 million blue loan will help Indorama Ventures, a global plastic resin manufacturer, reach its goal of recycling 50 billion PET (polyethylene terephthalate) bottles globally a year by 2025, including in Brazil, India, Indonesia, the Philippines, and Thailand. Ms Prince also highlighted the World Bank’s work on tackling plastic pollution in Albania and the Black Sea. In concluding, she said: “Just as green capital can be an engine for jobs and development, blue capital can help drive reconstruction, reduce poverty and help achieve food security. It is worth the investment.”

## Session One: Wrap-up and Observations

IAEA Director General Rafael Mariano Grossi wrapped up Session One and concluded that what the IAEA aims to achieve through NUTEC Plastics is neither an academic nor a policy-making exercise, but rather has a focus on projects and action-oriented efforts. Mr. Grossi said that the IAEA seeks to contribute to endeavours around the world, such as those mentioned by the high-level panellists in the session. Stressing that it is time for action, not for words, Mr Grossi assured the audience that the IAEA would continue the conversation and determine how the Agency and stakeholders can best support each other in tackling plastic pollution.

# Proceedings of the Roundtable

## Session Two

### Partnerships for Sustainable Solutions to Plastic Pollution



Ms Najat Mokhtar, IAEA Deputy Director General and Head of the Department of Nuclear Sciences and Applications

The second session of the Roundtable consisted of two panel discussions with distinguished panelists, chaired by **Ms Najat Mokhtar, IAEA Deputy Director General and Head of the Department of Nuclear Sciences and Applications**. This session highlighted available nuclear technologies for plastic waste recycling and marine plastic monitoring for science-based decision making in Europe and Central Asia. Panellists exchanged information on existing programmes and practices (e.g., R&D, industrial, regional initiatives and activities for capacity building and advocacy) and explored opportunities for new or enhanced cooperation and partnerships in NUTEC Plastics, including resource sharing and resource mobilization.

#### Session Two Panelists



Ms Bağdagül Karaağaç, Associate Professor, Engineering Faculty, Kocaeli University, Türkiye



Ms Doina Constantinescu, Senior Researcher, MONOFIL S.R.L., Romania



Mr Alexander Hofmann, Head, Department for Recycling Management, Fraunhofer UMSICHT, Germany



Mr Alexander Ponomarev, Head of Laboratory and Principal Researcher, Laboratory of Electron-Beam Conversion of Energy-Carriers, Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russian Federation



Mr Andrzej Chmielewski, Director-General, Institute of Nuclear Chemistry and Technology, Poland



Mr Michael Bank, Senior Scientist, Institute of Marine Research, Norway



Ms Lauren Biermann, Marine Remote Sensing Scientist, Plymouth Marine Laboratory, United Kingdom



Ms Tamara Galloway, Professor of Ecotoxicology, University of Exeter, United Kingdom



Mr Albert A. Koelmans, Head, Aquatic Ecology and Water Quality Department, Wageningen University, Netherlands



Ms Stephanie Reynaud, Director of Research, Institut des Sciences Analytiques et de Physico-Chimie pour l'Environnement et les Matériaux, France



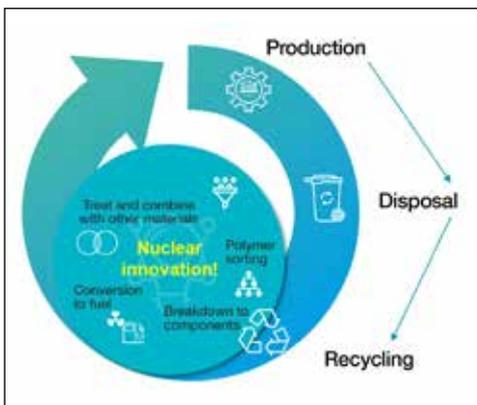
Ms Ana Catarino, Researcher, Flanders Marine Institute, Belgium



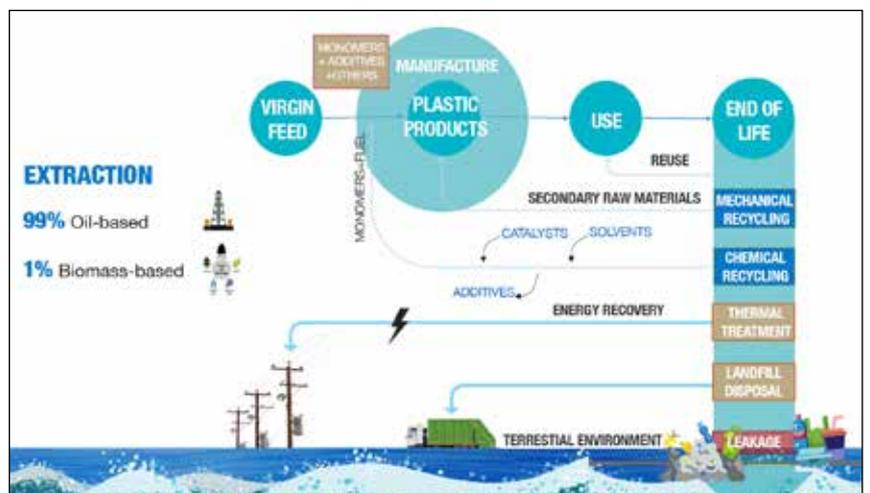
**Ms Melissa A. Denecke, IAEA Director, Division of Physical and Chemical Sciences, Department of Nuclear Sciences and Applications**, opened the panel 1 discussion with a presentation in which she outlined how radiation can support and extend conventional recycling strategies by enabling better sorting of plastic, breaking down plastic waste into components, converting plastic into fuel and feedstocks, and treating plastic waste to create upscaled products. Ms Denecke explained that as chemical recycling is an energy-intensive and expensive process, radiation technologies can be used

to lower the required process temperature and thus save resources, ensuring higher product purity. Moreover, radiation processing can be used to tailor the plastic’s properties and upscale the value of the secondary product to create novel and innovative materials with a higher market value. Ms Denecke explained how ionizing radiation is deployed to create and modify polymers in a green chemistry process. She informed participants that the IAEA is coordinating R&D efforts of Member States developing and testing radiation technologies to treat plastic waste, and that this knowledge and technology is ultimately more widely transferred to Member States. Through this coordination, the aim of the IAEA is to support Member States in establishing a plastic recycling pilot plant that would be docked onto a conventional mechanical recycling facility.

Following Ms Denecke’s presentation, several plastic recycling experts engaged in an interactive panel discussion and answered questions on challenges and opportunities related to radiation technology in tackling plastic pollution.



**Figure 1.** Nuclear innovation in the plastic value chain



**Figure 2.** Ionizing radiation can modify or breakdown polymer materials and thus contribute to mechanical or chemical recycling methods.



**Ms Bağdagül Karaağaç, Associate Professor at the Engineering Faculty of Kocaeli University, Türkiye,** offered an overview of polymer waste recycling methods that are still at an experimental stage and would benefit from complementary technologies. She stressed that commercially available thermal technologies for recycling plastics include pyrolysis, catalytic cracking, and conventional gasification, with plasma pyrolysis and microwave-assisted pyrolysis having recently gained particular attention. Ms Karaağaç added that alternative energy sources for devulcanization of elastomeric wastes are also currently being considered; and catalytic, plasma, vacuum and microwave-assisted pyrolysis are also under research.

With regard to the contribution that radiation technology can make to reduce polymer waste, Ms Karaağaç underlined that it could be used in particular to address the shortcomings of traditional recycling techniques, while also increasing the economic viability and the quality of products. Moreover, radiolysis has the ability to significantly reduce the energy required to convert plastic waste into gasoline and diesel fuel, while decomposing cellulosic contaminants in the plastic waste stream. Finally, Ms Karaağaç stressed that radiolysis has great potential to modify recycled materials via innovative ways such as in-situ grafting and surface oxidation processes.



**Ms Doina Constantinescu, Senior Researcher at MONOFIL S.R.L., Romania,** spoke about the advantages of international cooperation to implement radiation technology that would generate high-quality raw materials from plastic waste. She offered the example of a project developed in collaboration with the Technical University of Dresden in Germany aimed at creating a sustainable green reactive technology to prepare high-performance polymer composites from recycled materials. During the recent IAEA technical cooperation Virtual Workshop on the Technical-Economic Feasibility Studies to Implement Radiation Technology for the Recycling of Polymer Waste, various experts, including from the IAEA, shared experiences and best practices to ensure proper implementation of these technologies. Ms Constantinescu and her team have been developing a feasibility study for the pilot plant on plastic waste recycling in Romania.

Ms Constantinescu added that the advantages of introducing radiation technology for recycling plastic waste are:

- » Higher recovery of recycled thermoplastic polymers, obtaining over 99% pure final polymers due to the high-fidelity sorting;
- » Easy adaptation of radiation technology into the manufacturing flow;
- » Reduction of the need to use raw materials from the environment in the process.



**Mr Alexander Hofmann, Head of the Department for Recycling Management at Fraunhofer UMSICHT, Germany,** emphasized that while mechanical recycling has its limits, chemical recycling processes allow high-quality recycling of plastic waste. However, for high-quality downstream processing, corresponding methods for the purification of products from chemical recycling still have to be optimized and transferred to stable continuous operation. He stressed that radiation technology could also be used to overcome technical challenges posed by heat transfer in larger plants, as radiation could penetrate the feedstock, and energy can be transferred into bulk material.

Mr Hofmann mentioned some challenges that need to be surmounted to integrate radiation technologies into plastic waste recycling processes. In his view, the main difficulty lies in the safe placement of radiation technology in the pyrolysis reactor. In addition, sealing must be ensured, and the beam should be centred to the area where the feedstock in the reactor is located.



**Mr Alexander Ponomarev, Head of Laboratory and Principal Researcher at the Laboratory of Electron-Beam Conversion of Energy-Carriers, Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russian Federation,** stressed that the adaptation of radiation technologies to plastics recycling depends on the improvement of electron accelerators and informed of ongoing projects to develop proper accelerators. He added that cooperation with recycling companies is one of the key conditions in perfecting accelerators and adapting pyrolysis reactors to accommodate irradiation technologies.

Mr Ponomarev stated that radiation technologies for plastic recycling have a fairly competitive cost compared to conventional recycling, and underscored the possibility of combining radiation technology with conventional recycling. He concluded that thanks to its unique high speed, compatibility, energy efficiency and controllability, radiation technology could become an indispensable and inexpensive recycling method in the near future.



**Mr Andrzej Chmielewski, Director-General of the Institute of Nuclear Chemistry and Technology, Poland**, spoke of the role that the IAEA Collaborating Centres could have in supporting the NUTEC Plastics initiative. He underscored the scientific and technical expertise of the Collaborating Centres, which have the capability to lead such activities from the laboratory to the pilot scale. Moreover, Mr Chmielewski acknowledged the need to establish a platform for collaboration on

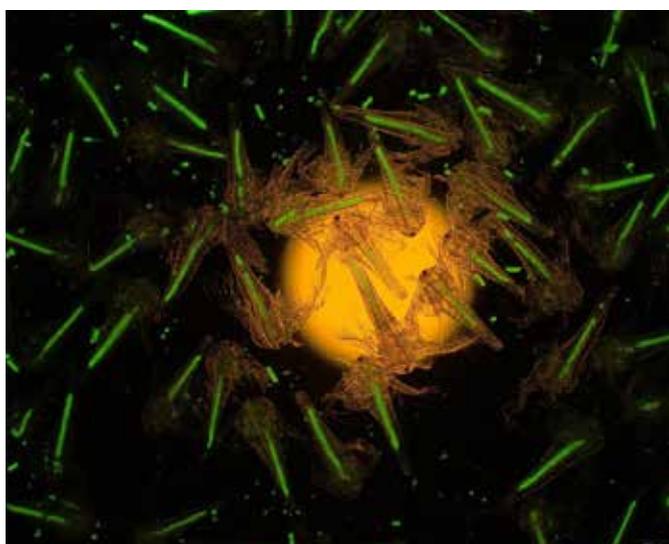
the subject of plastic pollution and that the IAEA has the possibility to act through its technical cooperation projects and Collaborative Research Projects.

Mr Chmielewski highlighted the problem of microplastics pollution caused by cosmetic residues rinsed into household drains without any precautionary recycling. In his view, one of the challenges in tackling this problem is the lack of technology that effectively retains microplastics at wastewater facilities. Mr Chmielewski informed that the University of Huddersfield in the United Kingdom, supported by the Institute of Nuclear Chemistry – a Collaborating Centre of the IAEA – has started research into the application of electron accelerators to treat microplastics. Finally, he reiterated that the electron beam treatment is a potential tool for the ecological, risk-free treatment of wastewater and sewage sludge contamination.



**Ms Florence Descroix-Comanducci, IAEA Director of the Marine Environment Laboratories in Monaco,**

opened the Panel 2 discussion with a presentation that offered an overview of current knowledge gaps regarding marine plastics, and ways to address them using nuclear and isotopic technologies. First, nuclear and isotopic techniques can be used to characterize and monitor microplastics, and they can identify marine plastics hotspots by evaluating the transfer, abundance, and transport of microplastics. Second, the use of radiolabelled chemicals and stable isotope labelling helps evaluate sorption and leaching from plastics and improve data accuracy.



Nauplii of brine shrimp *Artemia salina* after 3 hours of feeding with fluorescent nanoplastic. (Photo: F. Oberhaensli/IAEA)

The IAEA Marine Environment Laboratories in Monaco undertake radiotracer work to increase knowledge on how bioaccumulation of microplastics can impact the bioaccumulation of other contaminants. Ms Descroix-Comanducci also said that some unique radiotracer and radio imaging technologies allow the tracking of the fate and transfer of microplastics in the food chain and to assess stress for marine biota. She highlighted that the NUTEC Plastics initiative plans to enhance marine laboratory capacities in global mapping and the understanding of marine microplastics pollution, as well as to develop guides and protocols for sampling, quantification, and characterization of plastics.

Through NUTEC Plastics, the IAEA aims to leverage partnerships to facilitate wider utilization of isotopic techniques while also establishing a monitoring network of laboratories to exchange data, knowledge and best practices for marine plastic monitoring and impact assessment.

Following Ms Descroix-Comanducci's presentation, several experts engaged in an interactive discussion and answered questions on the science and technology needed for assessing plastic pollution.



Coral exposed to microplastics: Tropical coral *Stylophora pistillata* in the presence of fluorescent microplastic. (Photo: F. Oberhaensli/IAEA)



**Mr Michael Bank, Senior Scientist, Institute of Marine Research, Norway**, presented the Global Plastic Observation System (GPOS) that his institute is developing. He shared that the GPOS aims not only to bring together the professionals who work in the plastic pollution research and policy arena but also to enable them to think beyond marine environments and take a 'complex systems' approach to address this issue more holistically. He said that the ocean cannot be studied in isolation from other ecosystem compartments, including air and land, and that effective monitoring requires a global effort.

Mr Bank mentioned that other global scale programmes and environmental conventions are crucial for reporting and monitoring. Important infrastructures are already in place, including the IAEA TC programme, and programmes and organizations such as the EAF-Nansen programme, the Arctic Monitoring and Assessment Programme, the World Meteorological Organization, and the US-NOAA Marine Debris Program, which can all certainly be important pillars to support the initial framework of GPOS. This can be an 'achievable niche,' one that relies on reproducible science to support policy. He concluded by mentioning the interdisciplinary nature of plastic pollution and the strategic value of scaling up and establishing a unified and formal global effort to support public policy.



**Ms Lauren Biermann, Marine Remote Sensing Scientist, Plymouth Marine Laboratory, United Kingdom**, talked about the laboratory's work aiming to inform decision makers by understanding and explaining the impacts of marine plastic pollution. She emphasized the key role of legislation in tackling plastic pollution, such as a ban on single-use plastics by decision makers that would rapidly and measurably reduce a significant stressor on our freshwater and marine environments. Ms Biermann also pointed out the contribution of plastics to greenhouse gas emissions, stressing that plastic pollution and climate change are fundamentally linked.

Ms Biermann discussed how the Plymouth Marine Laboratory uses satellites for plastic detection in the marine environment. She stressed that the real challenge is detecting the plastics and then addressing the issue before they enter the open ocean, break down into microplastics, and do harm. Finally, she stressed the importance of related education for both the public and decision makers.



**Ms Tamara Galloway, Professor of Ecotoxicology, University of Exeter, United Kingdom,** emphasized that their laboratories study plastic waste because they have not yet found a seawater sample from anywhere in the world that does not contain tiny pieces of plastic or microplastics. She stated that European waters, in particular the Mediterranean, are some of the most contaminated in the world. She stressed that microplastics and their chemicals could seriously damage marine animals and humans.

To address this problem, Ms Galloway believes it is necessary to adopt the principles of a circular economy by redesigning the future with a new system, one that finds value in more sustainable ways. She said that it might be possible to have all the benefits of plastic packaging while avoiding the mountains of waste currently swilling around the planet, as research on plastics polymers made from seaweed suggests. This new generation of biopolymers show low toxicity to the environment and seems to break down quickly and harmlessly. In her opinion, this could also have a positive impact on climate change mitigation.



**Mr Albert A. Koelmans, Head of the Aquatic Ecology and Water Quality Department at Wageningen University, Netherlands,** spoke about the challenges of studying the impact of marine plastics on organisms, and ways to overcome them. One such challenge is assessing how and where the plastic continuum interacts with the continuum of species. For this reason, his laboratory captured the continuous distribution of characteristics of plastic particles in equations that can be used to assess risk. In addition, laboratory assays measure the microplastic concentration at which adverse effects on organisms start to occur. Mr Koelmans stressed that nanoplastics are potentially the most hazardous of marine litter and, to assess their risk, one needs to know the concentrations and characteristics of actual particles in the ocean. To date, there are no analytical methods available to get such data for environmental samples.

With regard to the effect of plastics as a vector of other pollutants to organisms, Mr Koelmans stated that clean, unpolluted animals would pick up chemicals from contaminated microplastic particles. However, only a fraction of pollutants comes via plastic, and that fraction has been assessed to be marginal.



**Ms Stéphanie Reynaud, Director of Research at the Institute of Analytical Sciences and Physico-Chemistry for Environment and Materials (IPREM), France,** presented a nanoplastic material that her team developed to create a research model to assess the risk posed by such plastics. She underscored that the use of radioactive or stable isotopes offers many advantages when labelling model materials, as they minimize any bias or modified particle behaviour compared to other methods. In addition, isotopic tracers benefit from imaging methods developed for nuclear medicine. Infrared and Raman spectroscopies may also be used with analytical techniques such as mass spectrometry, which is especially valuable for accessing trace-level concentration. Despite the availability of other techniques to better understand the transport and fate of marine plastics, such as fluorescent-stained samples and metal-doped nanoplastics, Ms Reynaud said that in her view the most promising approach is currently the development of isotopic nanoplastic materials.



**Ms Ana Catarino, Researcher at the Flanders Marine Institute, Belgium,** highlighted the importance of a multidisciplinary approach and capacity building activities to tackle plastic pollution. She gave the example of three projects on plastic pollution in which the Flanders Marine Institute is involved together with industry and government stakeholders and local communities, including from Africa and Asia. Ms Catarino stressed that the cooperation in the fight against plastic pollution, driven by scientific evidence, must include both a local and an international dimension. In her view, this would lead to engaged actions with the public and informed management solutions from decision makers. Finally, Ms Catarino highlighted that participating in future capacity building activities through the IAEA would be highly advantageous, as the IAEA has a well-established network of international stakeholders and scientific experts that are key to achieving sustainable solutions to tackle plastic pollution. Furthermore, she stated that the IAEA has the capacity to provide training to and promote knowledge transfer between technical staff and scientific experts.

## Session Two: Summary and Remarks

Session Two of the Roundtable was concluded by Ms Najat Mokhtar, Deputy Director General and Head of the Department of Nuclear Sciences and Applications, IAEA. She reiterated the importance of partnerships and collaboration to tackle plastic pollution and stressed that this challenge could only be overcome together. Ms Mokhtar underlined that the IAEA is ready to work with all stakeholders and to contribute to solving the issue through the Coordinated Research Projects and the IAEA technical cooperation programme.

## Proceedings of the Roundtable

### Closing remarks



Mr Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation (Photo: D. Calma/IAEA)

Mr Hua Liu thanked all panellists and participants for their support and valuable contributions to the Roundtable. He noted that over 300 participants from a wide range of governmental institutions, universities, research institutes, regional and international organizations, and private sector companies took part in the inspiring discussions on addressing plastic pollution. He stressed the diversity of participants, from Ministers and Deputy Ministers to heads of institutions, high-level decision makers, scientists, engineers and researchers.

Mr Liu reiterated that plastic pollution poses significant challenges to sustainable development and negatively affects the ocean, the food chain, human health and the environment. He noted that more than 26 million tonnes of plastic waste are generated every year in Europe and Central Asia, but that less than 30% of such waste is collected or recycled. Hence, he urged to step away from the linear 'take-make-waste' model and to move towards a sustainable circular economy for plastics, built on the 4R principles: reduce, reuse, recycle, and renew.

Mr Liu pointed out that radiation technology has the potential to improve plastic recycling while isotopic tracing technologies can play a major role in monitoring the behaviour and fate of microplastics in the seas and ocean. The IAEA is ready to contribute to the global response to plastic pollution through NUTEC Plastics.

As a way forward for Europe and Central Asia, Mr Liu presented several follow-up actions to be implemented, including:

- » Continue to support capacity building and plastic recycling under ongoing regional TC projects on radiation technology;
- » Strengthen the implementation of ongoing regional projects to monitor and address marine pollution and the impact of climate change in sediments and water in the Mediterranean, the Black Sea, the Caspian Sea, and the Aral Sea with 18 Member States from the region;
- » Conduct a survey on plastic waste management in TC Europe Member States. The survey results will serve as a baseline that will support future NUTEC Plastics technical cooperation projects that will effectively meet Member States' needs in line with available know-how;
- » Continue working closely with the IAEA laboratories and IAEA collaborative centres.

Finally, Mr Liu took the opportunity to reiterate his appreciation for the support of the participants and their important contributions.



The coordinated efforts of staff from various IAEA departments and divisions helped make the Roundtable discussion a reality. (Photo: D. Calma/IAEA)

***“This Roundtable marks the start of activities under NUTEC Plastics that will support the continuing development of new solutions to address plastic pollution, with a particular focus on the unique contributions of nuclear technology.”***

*Hua Liu, IAEA Deputy Director General  
and Head of the Department of Technical Cooperation*



Photos 1-2: The NUTEC Plastics Roundtable event for Europe and Central Asia was held at IAEA headquarters in Vienna, Austria on 7 October 2021

## Agenda of the Roundtable for Europe and Central Asia

### 10:00–11:20 Session 1: Plastic Pollution: Challenges and the Need for Global Action

- Welcome remarks: Ms Eve-Küllli Kala, IAEA Director, Division for Europe, Department of Technical Cooperation.
- Opening statement: Mr Rafael Mariano Grossi, IAEA Director General.
- Keynote address: Mr Peter Thomson, UN Secretary-General's Special Envoy for the Ocean.

#### **Roundtable with statements by Distinguished Panelists chaired by Mr Rafael Mariano Grossi, IAEA Director General.**

- HE Mr Mukhtar Babayev, Minister of Ecology and Natural Resources of Azerbaijan.
- HE Mr Levan Davitashvili, Vice-Prime Minister and Minister of Environment Protection and Agriculture of Georgia.
- HE Mr Ricardo Serrão Santos, Minister of Maritime Affairs of Portugal.
- Mr Virginijus Sinkevičius, European Commissioner for Environment, Oceans and Fisheries, Directorate-General for Maritime Affairs and Fisheries, European Commission.
- HE Mr Meelis Münt, Deputy Minister of the Ministry of Environment of the Republic of Estonia.
- HE Mr Christos Dimas, Deputy Minister for Research and Technology, Ministry of Development and Investments of the Hellenic Republic.
- Ms Halla Hrund Logadóttir, Director-General, National Energy Authority of Iceland.
- Mr Mats Svensson, Director, Swedish Marine Management Department, Swedish Agency for Marine and Water Management (on behalf of Mr Jakob Granit, Director-General).
- Mr Olivier Wenden, Vice President and Chief Executive Officer, Prince Albert II of Monaco Foundation.
- Ms Eli K. Vassenden, Vice President Shared Services, Grieg Star, Norway.
- Ms Bérengère Prince, Lead Natural Resources Management Specialist, World Bank Group.

Conclusion: Mr Rafael Mariano Grossi, IAEA Director General.

### 11:15–12:45 Session 2: Partnerships for Sustainable Solutions to Plastic Pollution

- Welcome remarks to Session 2: Ms Eve-Küllli Kala, IAEA Director, Division for Europe, Department of Technical Cooperation.
- Opening statement: Ms Najat Mokhtar, IAEA Deputy Director General and Head of the Department of Nuclear Sciences and Applications.

**Panel 1:** Innovation to mitigate plastic waste: Ms Melissa Denecke, IAEA Director, Division of Physical and Chemical Sciences, Department of Nuclear Sciences and Applications.

Panel discussion: Radiation technology for tackling plastic pollution.

- Ms Bağdagül Karaağaç, Associate Professor, Engineering Faculty, Kocaeli University, Türkiye.
- Ms Doina Constantinescu, Senior Researcher, MONOFIL S.R.L, Romania.
- Mr Alexander Hofmann, Head, Department for Recycling Management, Fraunhofer UMSICHT, Germany.
- Mr Alexander Ponomarev, Head of Laboratory and Principal Researcher, Laboratory of Electron-Beam Conversion of Energy-Carriers, Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russian Federation.
- Mr Andrzej Chmielewski, Director-General, Institute of Nuclear Chemistry and Technology, Poland.

**Panel 2:** Nuclear techniques for tackling marine plastics: Ms Florence Descroix-Comanducci, IAEA Director of Marine Environmental Laboratories, Monaco.

Panel discussion: Science and technology for assessing plastic pollution.

- Mr Michael Bank, Senior Scientist, Institute of Marine Research, Norway.
- Ms Lauren Biermann, Marine Remote Sensing Scientist, Plymouth Marine Laboratory, United Kingdom.
- Ms Tamara Galloway, Professor of Ecotoxicology, University of Exeter, United Kingdom.
- Mr Albert A. Koelmans, Head, Aquatic Ecology and Water Quality Department, Wageningen University, Netherlands.
- Ms Stephanie Reynaud, Director of Research, Institut des Sciences Analytiques et de Physico-Chimie pour l'Environnement et les Matériaux, France.
- Ms Ana Catarino, Researcher, Flanders Marine Institute, Belgium.

Wrap-up of panel discussions: Ms Najat Mokhtar, IAEA Deputy Director General and Head of the Department of Nuclear Sciences and Applications.

Closing remarks: Mr Hua Liu, IAEA Deputy Director General, Head of the Department of Technical Cooperation.

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