



**IAEA**

International Atomic Energy Agency  
*Atoms for Peace and Development*

# Circular Economy in the context of Nuclear Decommissioning

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# IAEA Statute : objectives



**Established in 1957**

**171 Member States**

**~ 2,560 multidisciplinary  
professional and support staff  
from more than 100 countries**



**ATOMS FOR PEACE AND DEVELOPMENT**

The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world.

# Main areas of work



Safeguards and Verification



Safety and Security



Science and Technology

**Gather Best Practices, support scientific development  
Publications, Coordinated Research Projects**

**Peace**

**Development**

**Disseminate Information and Support Programmes  
Networks, Peer Reviews, Technical Cooperation Projects**

# IAEA work aligns with Sustainable Developments Goals





# From Recycling to Circular Economy

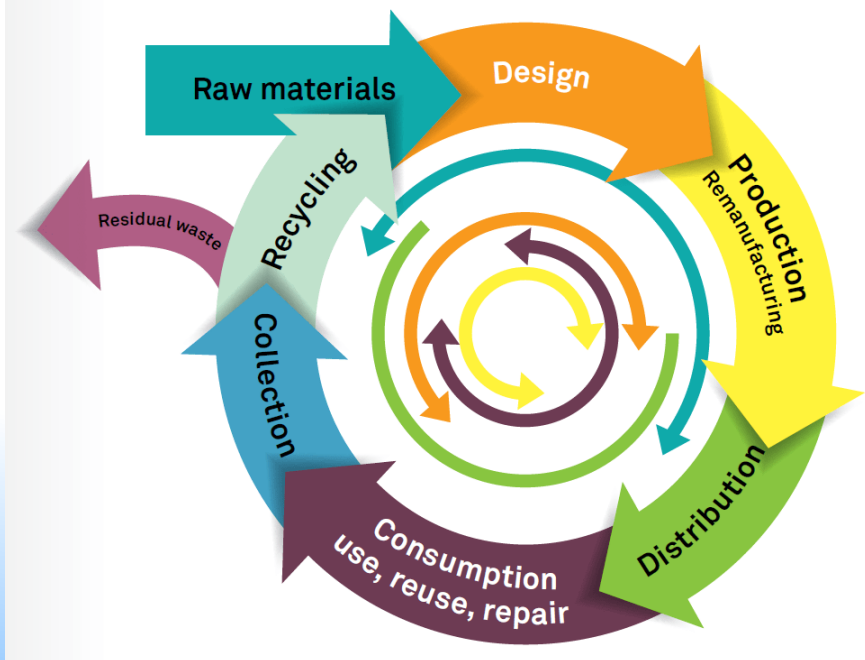


Almost 40% of the world copper is supplied by recycling

An average stainless steel object is made of 60% recycled material

58% CO2 emission saved thanks to ferrous scraps

Source: Bureau of International Recycling



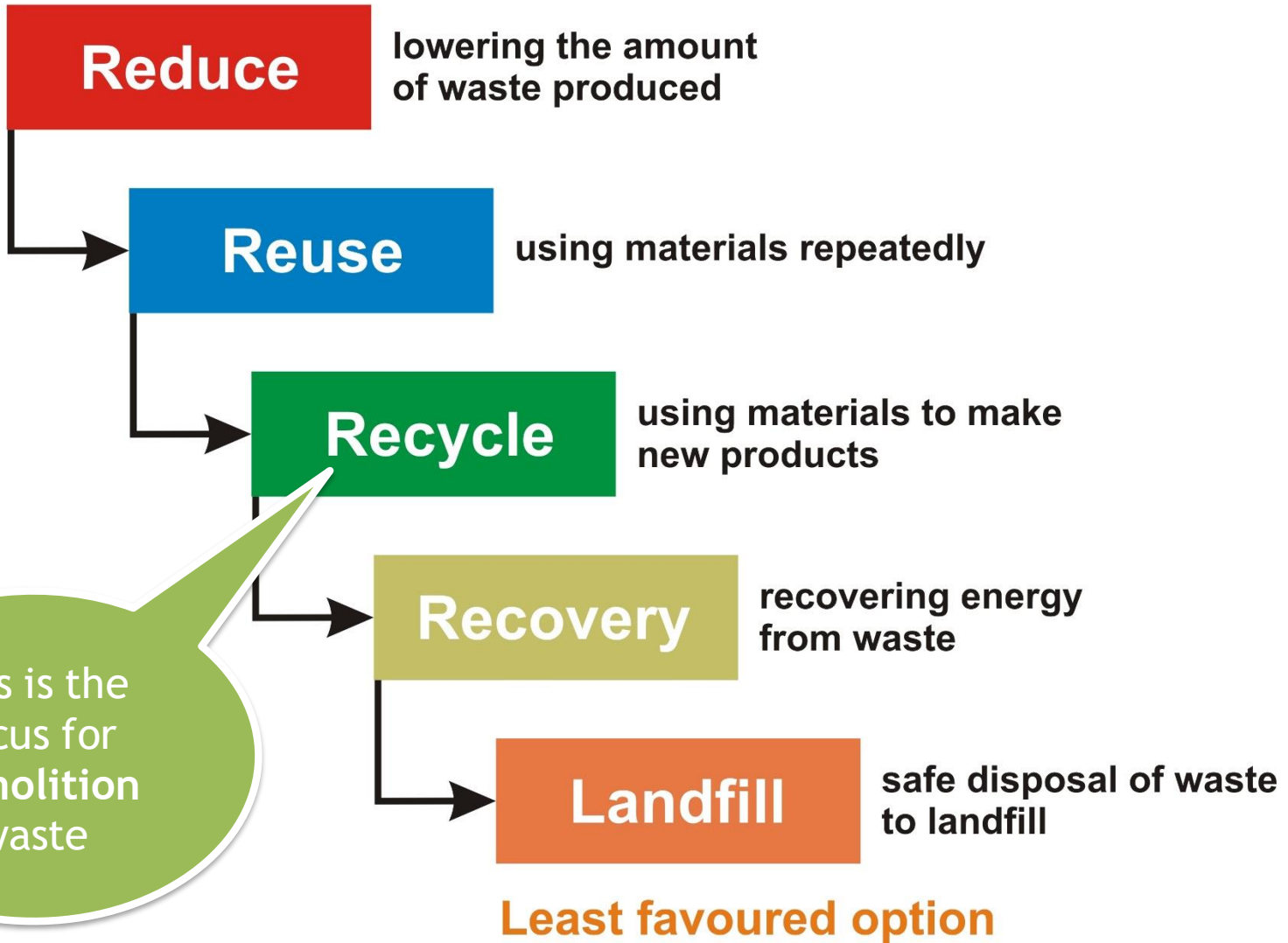
Design out waste and pollution – Ellen MacArthur Foundation

From linear to circular – Accelerating a proven concept (WEF 2014)

Circular Economy Action Plan – EC – March 2019

Circular Economy, CSR and Social Dimension

## Most favoured option



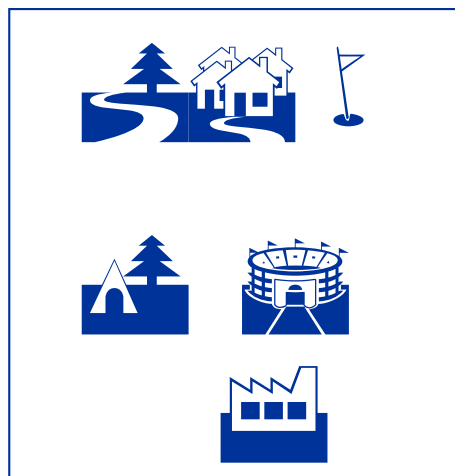
# Nuclear and Circular Economy



- **We are doing it !**
  - **Careful waste management and minimization**
  - **Life cycle analysis**
  - **Reduce and recycle**
  
- **We can do even more**
  - ➔ **Decommissioning: a new opportunity**

# Redevelopment and Reuse

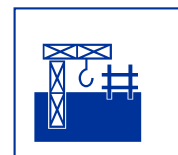
**REDEVELOPMENT!**



**SITING**



**CONSTRUCTION**



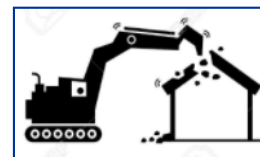
**OPERATION**



**AND NOW ?**



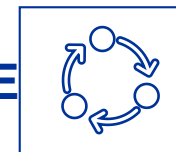
**DECOMMISSIONING**



**DISPOSAL**



**RECYCLE**

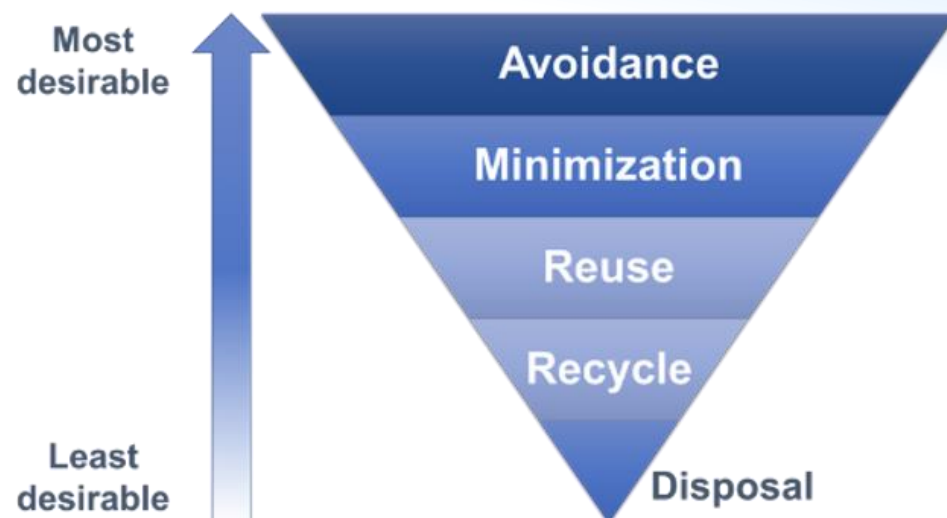




# During Operation (well before decommissioning)

- REDUCE

- Optimized design
- Preventive maintenance programme
- Life cycle analysis of any operation
- Waste zoning



- REUSE

- RECYCLE

- Part of several chemical processes used in fuel cycle
- Spent fuel management option

# During Decommissioning

- REDUCE

- Planning and Design, integrating decommissioning and waste management
- Life cycle analysis of any operation
  - Characterization, Sorting, Decontamination
  - Waste minimization: technical **and regulatory** → **avoid disposal**

Landfills are also a scarce resource

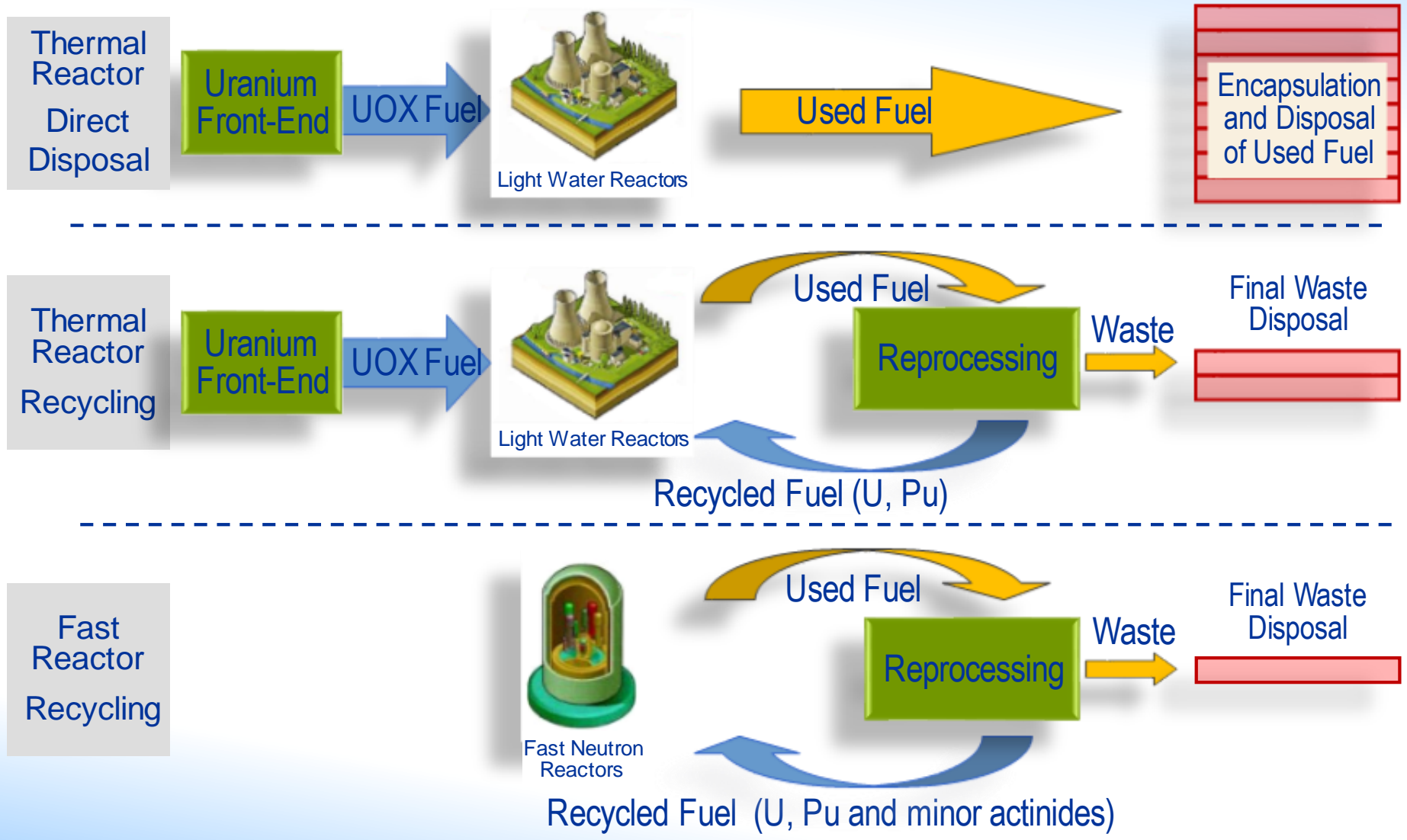
- REUSE

- Repurpose facilities, buildings and structures during decommissioning
- Send still usable equipment to another facility
- Reuse buildings and facilities for the next life – avoiding demolition

- RECYCLE

- Non radioactive materials in existing path
- Exemption and Clearance, allowing recycling in existing or dedicated path
- Recycle for new uses in nuclear industry (e.g. scrap metals)
- Spent Fuel

# Uranium Fuel Cycle Options / Going Circular



# Closing the loop: knowledge management

- From one generation to the next
- Lessons learned
- Feed-back to the design of new facilities

# IAEA supported tools

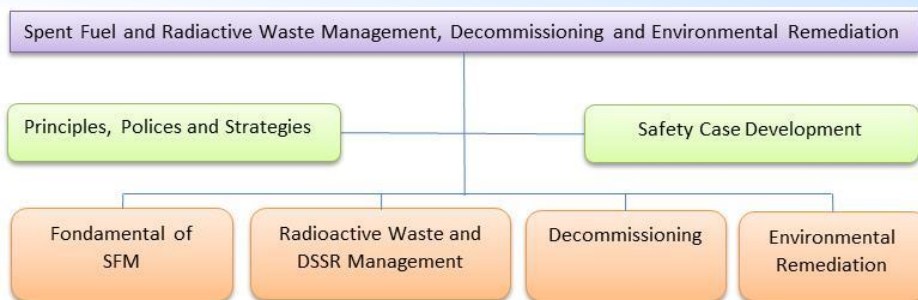
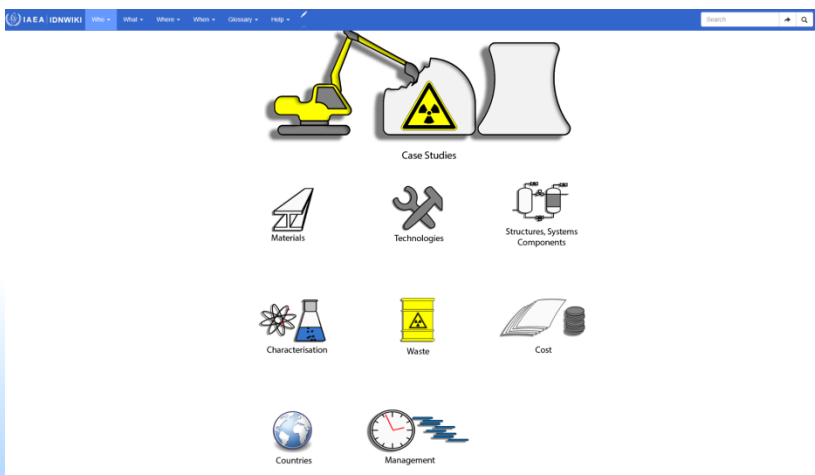
## IAEA Support: E-learning for stakeholders and newcomers to the field

<https://nucleus.iaea.org/sites/connect-members/LMS/Pages/Welcome-to-the-learning-materials-section.aspx>















## IAEA Support: Networks Web Based Tools to support information sharing

<https://nucleus.iaea.org/sites/connect/Pages/default.aspx>

Launched in 2016 : WIKI



### Networks

- 
**URF** Geological Disposal Underground Research Facilities for Geological Disposal  
[Learn More / Join URF](#)
- 
**DISP** International Low Level Waste Disposal Network Near Surface Disposal of Low Level Radioactive Waste  
[Learn More / Join DISPONET](#)
- 
**SFM** Spent Fuel Management International Network on Spent Fuel Management  
[Learn More / Join SFM](#)
- 
**IDN** International Decommissioning Network Decommissioning of Nuclear Facilities  
[Learn More / Join IDN](#)
- 
**CGULS** Coordination Group for Uranium Legacy Sites Coordination Group for Uranium Legacy Sites  
[Learn More / Join CGULS](#)
- 
**ICT** I&C Technologies Instrumentation and Control Technologies Network  
[Learn More / Join ICT](#)
- 
**MSN** Management System Network of Excellence Management System Network  
[Learn More / Join MSN](#)
- 
**LAB** International Network of Laboratories for Nuclear Waste Characterization LABONET - International Network of Laboratories for Nuclear Waste Characterization  
[Learn More / Join LABONET](#)
- 
**NKM** Nuclear Knowledge Management Network Nuclear Knowledge Management Network  
[Learn More / Join NKM](#)
- 
**ENV** Network on Environmental Management and Remediation ENVIRONET - Environmental Remediation and NORM Management Network  
[Learn More / Join ENVIRONET](#)
- 
**bDN** beta-Delayed Neutron Emission beta-Delayed Neutron Emission  
[Learn More / Join bDN](#)
- 
**IPN** International Predisposal Network forum for the sharing of practical experience and international developments on radioactive waste management activities before disposal.
- 
**NNE** Networking Nuclear Education Community of Practice
- 
**RSLs** Regulatory Supervision of Legacy sites International Working Forum





# Closing the loop: attracting workforce

## Challenges and Innovation

Decommissioning and Environmental Remediation  
**BE PROUD OF YOUR WORK**



Source: <http://editon.com/>



Source: <http://www.ghostbusters.com/>

From "Wastebuster" ...



... To "Green Giant" ...

Source: <http://cuisinertout simplement.com/>



Do GOOD: Be Part of the Circular Economy !

13 CLIMATE ACTION



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



# Sustainable Decommissioning Mindset



- Strategic view: decommissioning as a sustainable process to support further development of the site;
  - ➔ Post-decommissioning future of the site to be considered as the integral part of decommissioning planning
- CSR view: best use of the (most often taxpayer) money
- “We are not so special” view: Sustainable decommissioning lessons might be learned from non-nuclear industries
  - Availability of technologies and approaches
  - Reduction of costs, uncertainties and risks.

# Social and Economical Dimension: Decommissioning is the start of a new life

- Redevelopment

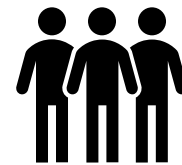


Energy and Material Research Center

- To be considered before action, in consultation with local communities
- Impact on what to keep, how to prepare the site for a new life

- Local employment

- During decommissioning
- Attracting businesses for the new life of the site





# Stakeholder Engagement – Another Key Aspect

## ❖ Generic: Mechanisms to enable decisions and approach

- Stakeholders include authorities, local and national government, NGOs
- Building trust over years is a long road, and maintaining it a must

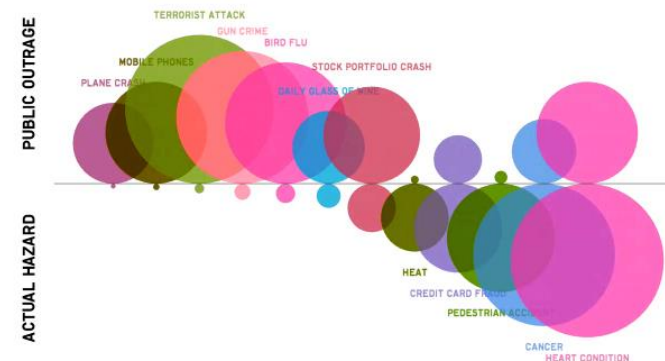


## ❖ Specific to Decommissioning

- Impact of the end of life of a facility on local economy
- Different / new types of risks to be managed

## ❖ Specific to Recycling and Circular Economy

- Addressing the “zero risk society”
- Economic value for the community



# All Involved



- **Society needs and expectations**
- **Policy vision**
- **Industrial pathways and processes**
- **Regulation**
- **Public Support**





# Looking ahead

## International Conference on the Management of Spent Fuel from Nuclear Power Reactors 2019

Learning from the Past, Enabling the Future

24–28 June 2019  
Vienna, Austria



Organized by the  
 **IAEA**  
International Atomic Energy Agency

#SFM19  
CN-3

## International Conference on **Climate Change and the Role of Nuclear Power**

7–11 October 2019, Vienna, Austria



Organized by the  
 **IAEA**  
International Atomic Energy Agency  
*Atoms for Peace and Development*

#Atoms4Climate  
CN-3

## International Conference on Research Reactors:

Addressing Challenges and Opportunities to  
Ensure Effectiveness and Sustainability

25–29 November 2019, Buenos Aires, Argentina



Organized by the  
 **IAEA**  
International Atomic Energy Agency

Hosted by the  
Government of Argentina  
through the  
National Atomic Energy Commission (CNEA)



**IAEA**

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*Thank you!*

# Useful Links

- Wiki: [https://idn-wiki.iaea.org/wiki/Main\\_Page](https://idn-wiki.iaea.org/wiki/Main_Page)
- Networks : <https://nucleus.iaea.org/sites/connect/Pages/default.aspx>



- eLearning: <https://nucleus.iaea.org/sites/connect-members/LMS/Pages/Module-Mindmap.aspx>
- INIS information repository: <https://inis.iaea.org/search/>

