

## FORESIGHT STUDY ON THE CIRCULAR ECONOMY AND ITS EFFECTS ON OSH: HOW TO IMPROVE PROSPECTS FOR THE MOST AFFECTED SECTORS

### Project background

The European Agency for Safety and Health at Work (EU-OSHA) has for several years been applying foresight approaches as part of its mission to contribute to safer and healthier working conditions in the EU. Its foresight approach looks at changes that may take place in the future and considers what their consequences could be for occupational safety and health (OSH), with the aim of supporting policymaking and raising awareness to reduce work-related accidents and ill health and improve safe and healthy working environments.

Within its third foresight cycle, work is focused on the circular economy (CE)<sup>1</sup> and its effects on OSH, primarily within the European context. This project is carried out against the background of an EU policy shift towards more environmentally sustainable practices, with several policy initiatives driving efforts in the CE arena.<sup>2</sup> These initiatives, and indeed the CE as a whole, are widely considered to be critical and influential developments that will be beneficial to the action against climate change and will ultimately have impacts on jobs and on OSH.

In phase 1 of the project, four macro-scenarios on the CE and its effects on OSH up to 2040 were developed following a key factor-based methodology,<sup>3</sup> which drew strongly from previous foresight work undertaken by EU-OSHA. The four scenarios demonstrate a broad range of future possibilities with potential implications for OSH covering a correspondingly wide area, that is, from a transformation approach that integrates OSH considerations at all stages, to product development and design to end-of-life recycling, to a world in which policymakers and stakeholders fail to grasp the opportunity to shape developments and in which economic success comes at the expense of both the environment and worker safety and health.

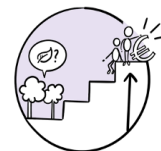
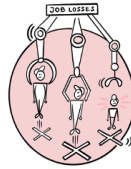
Phase 2 concentrated on zooming in on the details of stakeholder and sectoral perspectives to develop micro-scenarios that aim to shed further light on the working conditions and OSH implications within each scenario world. This policy brief covers the potential impacts the CE will have on worker safety and health in four of the most affected sectors (construction, energy, manufacturing and transport<sup>4</sup>) as identified by participants at a series of workshops held with key stakeholders in 2022. Also included are options for the key stakeholders, that is, measures that would improve OSH prospects going forward if taken in the near future. The table below shows the four macro-scenarios, with a short description listing each scenario's characteristics.

<sup>1</sup> For the purpose of this project, we have followed the definition of a CE put forward by the Ellen MacArthur Foundation: 'A Circular Economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.' See: <https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy>

<sup>2</sup> The key policy initiative in this space is the EU Commission's European Green Deal initiative that has the overarching aim of making Europe climate-neutral by 2050 (see: [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en)). Alongside the Green Deal initiative sits the Commission's 2015 CE package, comprised of an EU action plan for the CE ('Closing the Loop') with 54 concrete actions to achieve a CE, many with significant policy and regulatory implications for the sectors discussed in this brief (see: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0614>).

<sup>3</sup> For further details on the methodology behind the scenario development and the scenarios themselves, please see EU-OSHA, 2021a.

<sup>4</sup> In addition to the waste sector, which is covered in its own policy brief (see [https://osha.europa.eu/sites/default/files/2021-10/Policy\\_brief\\_Waste\\_Sector\\_0.pdf](https://osha.europa.eu/sites/default/files/2021-10/Policy_brief_Waste_Sector_0.pdf)), these four sectors were the sectors that participants identified at the workshops as being the ones most impacted by the transition to the CE.



<b>The Roaring 40s – Fully Circular and Inclusive</b>	<b>Carbon Neutrality – of a Hazardous Kind</b>	<b>Staying Afloat – Amid Economic and Environmental Crises</b>	<b>Regional Circularities – with European Divides</b>
In 2040, the products that sell best are those that are cradle-to-cradle and ‘net-positive’ in terms of social and environmental sustainability.	In 2040, Europe has achieved carbon neutrality. But with environmental outcomes taking top priority, job quality and working conditions have suffered – at least in some areas.	In 2040, work is what people want – any job will do. Keeping your head above the water is all that matters, the environment, social rights or job quality come a distant second.	By 2040, work has become a two-tier system: Contracted employees are well looked after, those in non-standard employment are not. Neither is the environment, with circularity being mostly regional.

Illustration showing an overview of the four scenarios

## Potential implications for OSH from the scenarios in the four most affected sectors

### Construction sector

1. The Roaring 40s – Fully Circular and Inclusive	2. Carbon Neutrality – of a Hazardous Kind	3. Staying Afloat – Amid Economic and Environmental Crises	4. Regional Circularities – with European Divides
<ul style="list-style-type: none"> <li>Use of prefabricated elements and robots in construction has led to a high degree of automation</li> <li>Environmental pollution (noise, etc.) has been reduced considerably</li> <li>In demolition, new risks (primarily exposure to ‘red list’ substances now banned in construction, such as lead or asbestos) come with the requirement to sort waste more carefully for recycling</li> </ul>	<ul style="list-style-type: none"> <li>A wide range of machinery is used on site, which results in a similarly wide range of safety issues as OSH considerations are low priority</li> <li>There is no or very little OSH-relevant upskilling or training</li> <li>New materials are introduced without careful checks for health impacts, and are used undocumented, leaving workers unaware</li> </ul>	<ul style="list-style-type: none"> <li>Cost-slashing measures result in falsified documentation to meet requirements, increasing OSH risks to workers during retrofits</li> <li>Lack of collective bargaining power makes it impossible for workers to demand positive OSH-related changes</li> <li>Increased on-the-job surveillance and AI human resources management results in stress and negative mental health impacts</li> </ul>	<ul style="list-style-type: none"> <li>As standards between regions vary widely, labour mobility between regions may confront workers with unexpected dangers</li> <li>Workers who are crucial to a worksite enjoy much better OSH provisions than others, increasing conflicts</li> <li>In less prosperous regions, use of surrogate materials reduces crucial (e.g. load-bearing) capacities, increasing the risk of sudden structural failure</li> </ul>

## Energy sector

5. <b>The Roaring 40s – Fully Circular and Inclusive</b>	6. <b>Carbon Neutrality – of a Hazardous Kind</b>	7. <b>Staying Afloat - Amid Economic and Environmental Crisis</b>	8. <b>Regional Circularities – with European Divides</b>
<ul style="list-style-type: none"> <li>• In the renewables sector, workers enjoy a high standing and are excellently trained and equipped, facing significant pressure to upskill as a result of the great pace of developments</li> <li>• Introduction of AI and further automation have considerably improved OSH conditions by removing workers from hazardous process steps</li> <li>• Lone working has increased as technology reduces the need for person power</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid expansion of renewables has come at the expense of OSH considerations, resulting in unforeseen risks to personnel, for example, if key safety features are not available when working at heights</li> <li>• The energy landscape has become extremely variable and dotted with small and medium-scale installations of vastly different safety standards</li> <li>• Workers have to work extremely flexible hours and often alone</li> </ul>	<ul style="list-style-type: none"> <li>• Cost pressures make workplace safety a secondary issue to both employers and workers, with safety features switched off or regulations ignored to increase speed of operations</li> <li>• The green transition has never been fully realised, with obsolete high-risk fossil fuel technology still in use</li> <li>• Platform work and subcontracting means that responsibility for OSH remains unclear</li> </ul>	<ul style="list-style-type: none"> <li>• In less affluent regions, a considerable backlog in maintenance has worsened safety for workers</li> <li>• Workers in waste incineration face environmental pollution at the workplace as a result of low regulatory standards</li> <li>• Outsourcing leads to more inexperienced workers handling complex machinery without adequate training</li> </ul>

## Manufacturing sector

9. <b>The Roaring 40s – Fully Circular and Inclusive</b>	10. <b>Carbon Neutrality – of a Hazardous Kind</b>	11. <b>Staying Afloat - Amid Economic and Environmental Crisis</b>	12. <b>Regional Circularities – with European Divides</b>
<ul style="list-style-type: none"> <li>• Life cycle perspective in risk assessment has led to a design focus on safe production, repair, reuse and recycling, improving OSH outcomes</li> <li>• AI surveillance helps protect workers, but can lead them to overestimate their abilities and underestimate risks</li> <li>• New materials are carefully checked prior to introduction into production processes, reducing short- and long-term risks to</li> </ul>	<ul style="list-style-type: none"> <li>• High degree of automation, while surveillance features are introduced with little regard for psychosocial health risks</li> <li>• New technologies and materials are introduced without full life cycle checks and without comprehensive information for workers</li> <li>• As production becomes more localised, responsibility for OSH supervision is not formally handed over</li> </ul>	<ul style="list-style-type: none"> <li>• Innovation is targeted primarily towards global competitiveness with no regard for production safety despite production processes having rapidly changed</li> <li>• As cost-cutting practices proliferate, workers receive little or no training in OSH</li> <li>• Use of cheap materials to replace other inputs leads to the re-emergence of new risks, for example, mechanical or thermo-mechanical failure during</li> </ul>	<ul style="list-style-type: none"> <li>• Invasive workplace surveillance increases psychosocial pressure, frequent privacy issues</li> <li>• In the bioeconomy, new processes are rolled out with incomplete testing</li> <li>• With no unified EU cyber strategy, smart manufacturing suffers from security issues that endanger workers as machines show unexpected behaviour</li> </ul>

9. The Roaring 40s – Fully Circular and Inclusive	10. Carbon Neutrality – of a Hazardous Kind	11. Staying Afloat – Amid Economic and Environmental Crisis	12. Regional Circularities – with European Divides
personnel	between institutions, and number of OSH inspections drops off	production	

▪ **Transport sector**

13. The Roaring 40s – Fully Circular and Inclusive	14. Carbon Neutrality – of a Hazardous Kind	15. Staying Afloat – Amid Economic and Environmental Crisis	16. Regional Circularities – with European Divides
<ul style="list-style-type: none"> <li>Automated driving has considerably reduced the risk of accidents and delays, as well as lowering skills requirements</li> <li>Lone working has increased, even if regionalised supply chains mean that driving distances and working hours are shorter</li> <li>Less environmental pollution and noise due to the ban on combustion engines</li> </ul>	<ul style="list-style-type: none"> <li>Cost-saving measures ('austerity') result in reduced numbers of OSH inspections in the transport sector</li> <li>In the preceding decades, public spending focused solely on delivering the energy transition, leading to crumbling transport infrastructure</li> <li>Transport workers have little bargaining power and no say with regard to job quality or safety standards</li> </ul>	<ul style="list-style-type: none"> <li>Uncommunicated updates may suddenly change capabilities of automated vehicles, surprising even well-trained workers</li> <li>Work crews are thinned out to reduce costs, significantly increasing workloads and lone working</li> <li>Simultaneous use of transport infrastructure by old and new technology vehicles results in unforeseen risks if pre-autonomous vehicles do not react to vehicle-to-vehicle communication</li> </ul>	<ul style="list-style-type: none"> <li>Autonomous vehicles have been introduced without full testing and may be susceptible to erroneous behaviour or be hacked</li> <li>Contradictory regulation between regions, also with regard to labour standards, further drives down OSH standards in the name of competition</li> <li>Transport infrastructure is not adapted to climate change and may fail structurally during the summer</li> </ul>

**European circular economies in 2040: Cross-cutting impacts for OSH from the scenarios in the most affected sectors**

Some of the potential implications identified for OSH from the CE in 2040 cut across the most affected sectors and are described in more detail below. Depending on the scenario, differences between regions (or Member States) will occur, depending on available investment capacity.

• **Digitalisation and automation**

With a wide range of applications, digital technologies offer many solutions for the challenges Europe will encounter during its move towards a CE. Here, digitalisation will play a role as a key enabler, for example, making it possible to track products and materials throughout their entire life cycle (with digital material and product 'passports' (JRC, 2022b)), calculate environmental footprints, or dematerialise processes (products



as a service). In addition, it will also continue to shape the world of work, as more process steps are automated, in particular in transportation, or can be done remotely.

Depending on the scenario, the leap forward in digitalisation and automation necessitated by the CE could also offer great potential for improvements in OSH. These are evident across all sectors: the key role played by mobility-as-a-service in a CE (World Bank, 2022) will lead to a significant growth in automated driving, which in turn will lower the risk of accidents and delays in transport (Shwartz, 2021; VTPI, 2022). Similarly, automation – used in the CE to act upon real-time data analysis with the aim of reducing waste and optimising resource use – will help to reduce physical workloads and risks (ILO, 2019), but could also make work less diversified and increase ergonomic hazards (CCOHS, 2022). Finally, the push to increase remote work as a way of reducing mobility and commercial space footprints in the CE (Martin et al., 2022) could lead to an increase in lone working and to more stress and anxiety.

- **Robotics and AI**

Depending on the legislative environment and the business stakeholders' ability to invest, the pace and extent of technology diffusion will vary widely. Robotics offer great potential in all four sectors, from bricklaying machines (Ackerman, 2022) to the use of robots in building offshore wind farms (Mathis, 2022), while AI has the ability to change work organisation and take over crucial roles, including OSH-relevant warning functionalities (Ponce Del Castillo, 2018). However, as robots and machines become more independent, their actions become less predictable and may increase hazards for workers (ILO, 2019). Hence, some uncertainty remains regarding the degree of their implementation in 2040 (ILO, 2019).

In all four sectors, the impact of automation and AI on OSH will depend greatly on the regulatory landscape. If the focus of AI support is on increasing safety (e.g. warning workers of unsafe behaviour) rather than productivity (EPRS, 2022), or on improving the employee experience to lower stress (Malik et al., 2022), outcomes will be overwhelmingly positive. Should it, however, be used as a tool for surveillance, impacts on mental health will be negative (EU-OSHA, 2022a; Yam et al., 2022) and lead to stress, burnout and anxiety. While robots are expected to handle physically dangerous work, for example, in construction (ILO, 2019), a perfunctory integration of AI and robots would make robots less predictable for workers (EU-OSHA, 2021b) and increase hazards. Finally, even a well-regulated further development of automation would bring an increase in lone working with the associated psychosocial risks.

- **New materials and processes**

The ambitious targets of the European Green Deal will be difficult to achieve without recourse to advanced materials and novel processes, in particular with regard to renewable and biodegradable materials, or materials used in renewable energy or to increase efficiency (AMI, 2022). Further innovative advances can be expected as a result of the increased convergence of technologies, particularly with regard to nanomaterials and processes in industrial biotechnology. In the manufacturing, construction and energy sectors, rapid adaptation of these developments will be necessary to achieve the ambitious standards planned for the near to mid-future (replacing non-renewable inputs, improving building energy efficiency, or increasing the performance of renewables, etc.).

However, these new materials also present unique challenges when it comes to OSH, in particular if potential health issues are not, or not completely, explored prior to introduction (ILO, 2019; OECD, 2022). The lower the barrier to entry is (e.g. in biotechnology), the greater the risk of misuse (McKinsey, 2020). Here, the OSH implications for the sectors across the scenarios demonstrate that stringent documentation / labelling and life-cycle assessments will be necessary to keep hazards to workers to a minimum.

- **Regulatory measures, standardisation and documentation**

Policymakers have already been tasked to better integrate OSH issues into procurement standards by developing a holistic approach focusing on circularity and worker safety (see JRC, 2022a), similar to the 'sustainable by design' chemicals strategy in the context of the European Green Deal. Current initiatives, for

example, the REACH<sup>5</sup> revision for a toxic-free environment, already showcase the process towards reducing pollution and increasing safety (European Commission, 2022), while measures such as digital twins and material passports (see JRC, 2022b) present a way towards improving documentation of substances and inputs used in manufacturing.

In all four scenarios, regulatory measures – or their absence – are a key factor in determining OSH outcomes. Here, a lot will depend on the policymakers' approach – if OSH is made a primary concern in all relevant legislation and clear standards are set to avoid the distortion of competition between Member States, worker health and safety will be protected from cost-cutting practices (Nachhaltigkeitsrat, 2021). Similarly, a shift towards evidence-informed and also foresight-based policies, away from the focus on quantitative impacts, would also help to achieve better regulatory outcomes (see for example, DGIP, 2022a).

- **Reskilling**

Climate policies will have a strong impact on workers, and require massive training, reskilling and upskilling: on average, low-carbon jobs, which will provide a much greater percentage of total jobs in the CE, have higher skills requirements across a broad range of skills (Saussay et al., 2022), and past energy-related transitions have shown that qualification measures play a key role in enabling workers able to find new jobs (Vandenbussche, 2021). The EU's Just Transition Mechanism (see EPC, 2021) is intended to achieve just that by providing regions with the funds necessary to use the transition to a CE as an opportunity for large-scale upskilling. In addition, the EU's Lifelong Learning Programme will also help to develop the learning sector in Europe in the future.

The scenarios have shown that in all sectors, skilling and reskilling will have a huge impact on future OSH outcomes. Making OSH considerations an integral part of all qualification measures would ensure that workers acquire the knowledge to navigate the world of work safely, and by promoting individual learning accounts and micro-credentials, based on the EU's 'Action to improve lifelong learning and employability' (European Commission, 2021), regions will be able to ensure that participation will be high.

## Conclusions

The transition towards a more circular economy offers opportunities to improve conditions in OSH for workers in many sectors, in particular those that are most affected by this change in economic system. Unless each of these sectors performs to significantly higher standards, the EU will not be able to fulfil its ambitious objectives. New challenges to OSH will have to be met, but if OSH considerations are made a priority in the transition process, opportunities will arise that offer the chance to considerably improve future outcomes for workers.

Authors: Cornelia Daheim, Jessica Prendergast and Jörg Rampacher (Future Impacts).

Visualisations: Michelle Winkelsdorf

Project management: Annick Starren, Yuri Bruinen de Bruin, Emmanuelle Brun, European Agency for Safety and Health at Work (EU-OSHA)

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<sup>5</sup> REACH is the acronym used for 'Registration, Evaluation, Authorisation and Restriction of Chemicals'.

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