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GREEN-LOOP

Sustainable manufacture systems towards novel bio-based materials

D8.11 – Report on Occupational safety and health for GREEN-LOOP manufacture systems (M14)

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GREEN LOOP Consortium Partners

	Partner	Acronym	Country
1	IDENER RESEARCH & DEVELOPMENT	IDE	ES
2	NATIONAL INSTITUTE OF CHEMISTRY	NIC	SI
3	SLOVENIAN NATIONAL BUILDING AND CIVIL E. I.	ZAG	SI
4	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	FHF	DE
5	LABRENTA SRL	LBRT	IT
6	MIXCYCLING SRL	MYX	IT
7	NERO SU BIANCO	NSB	IT
8	GERACE MARIA CRISTINA - TERRE DI ZOE'	TDZ	IT
9	IRIS TECHNOLOGY SOLUTIONS, SOCIEDAD LIMITADA	IRIS	ES
10	GLOWNY INSTYTUT GORNICTWA	GIG	PL
11	AACHEN UNIVERISTY: PROCESS CONTROL ENGINEERING / AACHEN UNIVERISTY: INSTITUTE OF SOCIOLOGY	AAU	DE
12	AUSTRIAN STANDARDS INTERNATIONAL	ASI	AT
13	INSTITUTO DE SOLDADURA E QUALIDADE	ISQ	PT
14	AXIA INNOVATION UG	AXIA	DE
15	ASOCIACIÓN DE INVESTIGACIÓN METALÚRGICA DEL NOROESTE	AIMEN	ES
16	NATIONAL COMPOSITE CENTER	NCC	UK
17	UNIVERSITY OF BRISTOL	UBRIS	UK

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Executive Summary

The GREEN-LOOP project has demonstrated the potential for circular economy principles to drive innovation in the bio-based product sector. To avoid problems regarding the exploitation of the products, the terms of standard regulations for the occupational health and safety will be considered from the beginning of the project.

NSB is responsible for performing a study of current and forthcoming directives affecting the manufacturing processes and the expected bio-based materials and products that will be developed in GREEN-LOOP. This study, started from M9 and will continue until M36, will incorporate technical specifications delivered during the activities developed in T1.2.

Deliverable 8.11 "Report on Occupational Safe and Health for GREEN-LOOP manufacture systems" describes the Health and Safety issues for ensuring the health and safety of all workers. A first delivery at month 14 following results from the initial T8.6 Health and Safety (H&S) study implementation, includes also checklist for Gender and Diversity dimension in OSH elaborated by AUA (Annex 3).

Then, from month 15, Dev8.11 will be circulated through T8.4 Trainings and Social Engagement lead by ISQ, with an internal training session delivered by NSB together with AUA.

The deliverable will be updated with two new reports at M24 and M36, considering that regulations and directives can change over time, and it's important to refer to the latest legislation and consult with legal experts or regulatory authorities for the most up-to-date information.

In order to identify new risks and to anticipate changes that could have an impact on OSH, NSB involved in a joint survey all the relevant technical GREEN-LOOP partners involved in the implementation of the technical solutions for the three identified value chains dealing with different manufacturing processes.

The questionnaire of the survey will be updated and replicated by the end of the second year of GREEN-LOOP implementation and by the end of the project in order to collect relevant data by M24 and by M36.

The value chains included in the GREEN-LOOP project are targeting innovative bio-base final products such as multifunctional rubber panels with fire resistance and anti-vibrational properties for the civil application, bioplastic bottle closures for the packaging, food, and beverage sectors, and wood composites for the production of sliding bearings for the appliance sector. The three value chains and the relative mapping processes are explained in detail. The main actors involved along the value chains and the end-of-life approaches are highlighted to allow the mapping of the whole process. Each value chain will be analysed and mapped following a dedicated strategy at M24 and then at M36.

In Introduction, describes shortly the GREEN-LOOP value chains, including the OSH issues for the multifunctional rubber panels for the construction sector, bottle closure for the food and beverage sector, and wood composite bearings for the tool and appliance sector.

The challenges of OSH are introduced including main principles and risks to be verified, and their importance in achieving the OSH directives, and some relevant EU and UK directives are listed to provide the main framework of regulations.

The methodology for the OSH study and the planned actions for the GREEN-LOOP value chains is presented. A questionnaire has been developed and distributed to the main partners involved in the three value chains to understand which grade of H&S is implemented within their R&D activities. Some references of the current standards applied from partners of the three value chains have been collected and included in the list of the current Dev8.11 (M14).

At M24, NSB with the view to analyse the flows of the value chains of the GREEN-LOOP bio-products' proposes an OSH assessment will be based on processes analysis. OSH indicators for of the GREEN-LOOP project will be elaborated for each of the three value chains.

A Check List on OSH issues for the GREEN-LOOP Manufacturing processes is delivered at month 14 (Annex 2) and it will be updated at month 24 and at month 36.

At month 36, A step further conducted by NSB will consist of the suggestion of a roadmap of future actions to be implemented while reaching a higher level of H&S standard, and final recommendations on the Gender dimension issues will be covered by AACHEN University.

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Abbreviations

BE	Bioeconomy
BR	Butadiene Rubber
BoL	Beginning of Life
BSC	British Safety Council
CI	Circularity Indicators
CBE	Circular Bioeconomy
CbD	Circularity by Design
CE	Circular Economy
EU	European Union
EU-OSHA	European Union - information agency for occupational safety and health
ILO	International Labour Organisation
IIR	Butyl Rubber
KPI	Key Performance Indicator
TRL	Technology Readiness Level
MCI	Material Circularity Indicators
MoL	Middle of Life
NTP	Non-thermal plasma
OEM	Original equipment manufacturer
OSH	Occupational Safety and Health
REACH	EU regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals
SBR	Styrene butadiene rubber
SCA	Strategic Circular Actions
UK	United Kingdom
VCs	Value Chains

Introduction

Circular economy (CE) has gained considerable attention in the last decade among the scientific community and civil society. The Circular concept within the economy implies that products and services should slow, narrow, and eventually close the loop of materials and resources within organizations' production processes. Consequently, there are several strategies advocated for the shift from conventional linear and behavioural thinking of organizations, consumers, and decision-makers towards a circular economy concept. Moreover, economic aspects such as production procedures and financial outcomes are strongly considered as well.

The transition to a circular economy is one of the key aspects of the ambitious goals of the European Union (EU) of becoming the first “climate neutral” continent by 2050, to make a “cleaner and more competitive” Europe. A successful shift to a circular economy could help meet the Sustainable Development Goals, the Paris Climate Agreement targets, and the ambitions of the European Green Deal and reach carbon neutrality in Europe by 2050[1].

A circular economy in the bio-based industry involves designing and producing products that minimize waste and maximize resource efficiency. It aims to keep materials in use for as long as possible by adopting sustainable practices throughout the entire value chain, from sourcing raw materials to disposal. The use of renewable, bio-based materials that can be regenerated and reused helps to reduce the environmental impact of the industry. By creating closed-loop systems where waste is minimized and materials are kept in use, the circular economy can help build a more sustainable and resilient bio-based industry that benefits both the economy and the environment.

The GREEN-LOOP project is a remarkable example of a circular economy in action. It aims to provide bio-based materials solutions through innovative manufacturing techniques and efficiency improvements, all in accordance with circular economy principles. The project concentrates on three value chains that are optimized from raw materials to final products using smart manufacturing technologies, such as artificial intelligence, microwave, and ultrasound. These techniques guarantee that production processes are optimized for efficiency and sustainability, reducing waste and minimizing resource consumption.

The three value chains are the following:

- Multifunctional rubber panels with fire resistance and anti-vibrational properties for civil application
- Bioplastic bottle closures for the packaging, food and beverage sectors
- Wood composites for the production of sliding bearings for the appliance sector

The three value chains reflect the circular economy principles. The raw materials used are bio-based or made of recycled materials, and the final product is going to be recycled by using ad hoc techniques that will be described in the following sections along with a deep analysis of circularity implementation in two levels.

This project aims to provide EU decision-makers, Member State governments, trade unions and employers with the information they need on future changes and developments related to the circular economy, their impact on the nature and organisation of work, and the emerging challenges to OSH that they may bring.

Transitioning to a CE is a key driver of the EU goal of achieving carbon neutrality by 2050 while creating sustainable growth and jobs. It has significant policy and regulatory implications that will affect future jobs. It will also have consequences for workers’ safety and health. For example:

its impact on jobs in hazardous sectors, related to maintenance and repair, disassembly and recycling, could have a negative impact on working conditions; changes in organisational processes and/or redesigning tasks could have an impact on job content and satisfaction.

The EU-OSHA’s foresight projects draw on a variety of methods, including literature reviews, consultation with experts and scenario-building.

EU-OSHA organises workshops to gather knowledge, help promote the results and stimulate debate. The transition to a circular economy (CE) demands new business models, new ways of working that may result in new risks to workers' health and safety.

[1] ETC/WMGE Report 2/2021: Business Models in a Circular Economy

The report “Foresight study on the circular economy and its effects on occupational safety and health: Phase 2 – micro-scenarios” presents the results of phase 2 of this foresight study on CE. It involved stakeholder dialogues at four workshops in 2022. During these workshops, participants explored future possibilities and identified specific implications for occupational safety and health (OSH). Based on these discussions, the report presents key actions needed to shape a human-centred approach to OSH in the transition to a European CE.

The project findings by EU-OSHA suggest that concerted key actor measures offer the best option for achieving positive OSH outcomes. GREEN-LOOP will take advantage of this evidences by improving links between European and national agencies, the project partners and other actors, integrating shared OSH standards into broader EU environmental policies, and constantly updating OSH guidance and education through timely exchange of information and stakeholder consultation, an anticipatory approach is possible that enables all involved to create well-balanced rules and regulations focused on improving the health and safety of workers across the EU and the UK.

1. Occupational safety and health (OSH)

Occupational safety and health (OSH), also known as workplace safety and health, is a multidisciplinary field that focuses on ensuring the well-being, safety, and health of workers in their workplaces. The primary goal of OSH is to prevent work-related injuries, illnesses, and fatalities, as well as to promote and maintain a safe and healthy work environment for all employees.

This field encompasses various aspects, including:

Workplace Safety: which includes measures and practices designed to protect workers from physical hazards, such as machinery accidents, falls, electrical shocks, and fires. It involves the use of safety equipment, machine guarding, and safety training to reduce the risk of accidents.

Occupational Health: This aspect deals with the impact of work on the physical and mental health of employees. It includes the identification and control of health hazards in the workplace, such as exposure to harmful chemicals, noise, and ergonomic risk factors.

Health and Safety Management Systems: often involves the implementation of systematic approaches to manage workplace safety and health, such as the development of safety policies, procedures, and risk assessment practices.

Regulations and Compliance: relevant regulations and standards are put in place by the EU and the UK. and National governments and regulatory bodies to establish minimum safety and health requirements for workplaces. Employers are typically required to comply with these regulations to protect their employees.

Training and Education: Proper training and education are essential components of OSH. Employees need to be informed about potential workplace hazards, safe work practices, and how to use safety equipment.

Risk Assessment and Hazard Identification: OSH professionals and employers conduct risk assessments and identify potential workplace hazards to implement preventive measures.

Emergency Preparedness: OSH involves planning for emergencies, such as fires, chemical spills, or medical emergencies, and ensuring that workers are adequately trained and equipped to respond effectively.

Ergonomics: Ergonomics focuses on designing workspaces and tasks to fit the capabilities and limitations of the workers to minimize physical strain and discomfort.

Occupational Hygiene: This involves the control of physical and chemical exposures in the workplace, including monitoring air quality, noise levels, and exposure to hazardous substances.

Psychosocial Aspects: OSH also addresses psychological factors in the workplace, such as stress, harassment, and workplace bullying, which can impact the mental health and well-being of employees.

Health Promotion: Some programs include health promotion activities to encourage employees to adopt healthy lifestyles and practices that contribute to their overall well-being.

OSH is a critical aspect of any organization or industry, as it not only protects employees from harm but also contributes to increased productivity, reduced absenteeism, and a positive work environment. In the EU countries and in the UK, OSH is regulated by governmental agencies, and employers are legally required to provide a safe and healthy workplace for their employees. Compliance with OSH regulations is essential for maintaining the safety and health of the workforce.

2. Main EU regulations for OSH in bio-value chains

European regulations related to health and safety in bio-value chains manufacturing consists of some relevant directives:

- **REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals)**:

This regulation addresses the production and use of chemical substances in the European Union. It has implications for the use of chemicals in bio-value chains and requires companies to ensure the safe handling of chemicals in their processes.

- **Biocidal Products Regulation (BPR)**:

BPR governs the placement of biocidal products on the EU market. Bio-value chains manufacturing may involve the use of biocidal products, and compliance with BPR is necessary to ensure their safe use.

- **Genetically Modified Organisms (GMO) Regulations**:

The EU has strict regulations concerning the release and marketing of genetically modified organisms and products derived from them. If bio-value chains involve GMOs, companies need to comply with these regulations.

- **Chemical Agents Directive (CAD) and Carcinogens and Mutagens Directive (CMD)**:

These directives pertain to the protection of workers from exposure to chemical agents and carcinogens in the workplace. Compliance with these directives is essential for ensuring the safety of employees in bio-value chain manufacturing.

- **Directive 2000/54/EC on Biological Agents at Work**:

This directive focuses on the protection of workers from risks related to exposure to biological agents at work. It is relevant in bio-value chains, which may involve the handling of biological materials.

- **Directive 98/24/EC on Chemical Agents at Work**:

This directive sets out minimum requirements for the protection of workers from risks related to exposure to chemical agents at work. It is relevant for bio-value chains where chemical agents are used.

- **Environmental Protection Legislation**:

Bio-value chains may also need to comply with various environmental regulations related to waste disposal, emissions, and the impact of manufacturing processes on the environment.

As the EU directives may will be changed or updated in the next months of project implementation, before M24 and M36, it will be essential to consult with EU agencies, as EU-OSHA, to ensure compliance with the most current health and safety regulations for bio-value chains manufacturing.

3. Main UK regulations for OSH in bio-value chains

The United Kingdom follows a regulatory framework that is partly aligned with European Union regulations, especially in the context of health and safety. However, since the UK left the EU, there may have been changes and updates in UK legislation. To ensure compliance with the most up-to-date regulations, it's essential to consult with UK regulatory authorities and legal experts. Here are some relevant UK directives and regulations related to health and safety in bio-value chains manufacturing:

- **Health and Safety at Work Act 1974:**

This is the primary piece of legislation governing health and safety in the workplace in the UK. It places a general duty on employers to ensure the health, safety, and welfare of employees and others affected by their work activities.
In the UK, Workplaces are required to provide: Adequate staff training to ensure health and safety procedures are understood and adhered to adequate welfare provisions. A safe working environment that is properly maintained and in which operations are conducted safely.

- **Control of Substances Hazardous to Health (COSHH) Regulations:**

COSHH regulations require employers to control exposure to hazardous substances, which may include chemicals and biological agents used in bio-value chain manufacturing.

- **Genetically Modified Organisms (Contained Use) Regulations 2014:**

These regulations govern the contained use of genetically modified organisms (GMOs) and aim to ensure the protection of human health and the environment when working with GMOs in a contained setting.

- **Biocidal Products Regulations 2013:**

This regulation pertains to the use and placing on the market of biocidal products. If bio-value chains manufacturing involves the use of biocidal products, these regulations are relevant.

- **The REACH (Amendment etc.) (EU Exit) Regulations 2019**:

After the UK's exit from the EU, regulations related to the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) have been amended to align with UK law. These regulations impact the use of chemicals in bio-value chain processes.

- **Control of Major Accident Hazards (COMAH) Regulations**:

If bio-value chains involve the use or storage of hazardous chemicals, the COMAH regulations may apply, ensuring the control of major accident hazards.

- **Biological Agents Regulations 2005**:

These regulations are relevant when working with biological agents that may pose risks to the health and safety of workers. This includes activities in bio-value chains that involve the handling of biological materials.

- **Environmental Permitting Regulations**:

If bio-value chains manufacturing processes have environmental impacts, companies may need to obtain environmental permits under these regulations.

- **Waste Management Regulations**:

Proper disposal and management of waste generated in bio-value chains must comply with UK waste management regulations.

As the UK directives may will be changed or updated in the next months of project implementation, before M24 and M36, it will be essential to consult with UK agencies, as BSC, to ensure compliance with the most current health and safety regulations for bio-value chains manufacturing.

4. OSH focusing on manufacturing processes of GREEN-LOOP

The manufacturing of novel bio-based materials, like any industrial process, poses specific health and safety concerns for workers. These concerns may vary depending on the specific processes and materials involved, but some common issues include:

Exposure to Hazardous Chemicals and Biological Agents: Workers may be exposed to chemicals, solvents, and biological agents used in the production of bio-based materials. Proper handling, storage, and disposal of these substances are essential to prevent chemical and biological hazards.

Dust and Particulate Matter: Some manufacturing processes may generate dust and particulate matter. Prolonged exposure to airborne particles can lead to respiratory issues, so adequate ventilation and personal protective equipment (PPE) are crucial.

Noise Exposure: The machinery and equipment used in manufacturing can generate high levels of noise, which can lead to hearing damage over time. Hearing protection and noise reduction measures are necessary.

Machine Safety: Workers operating manufacturing machinery are at risk of injuries, such as cuts, crush injuries, and entanglement. Proper training, machine guarding, and safety protocols are essential to prevent accidents.

Ergonomics: Poor ergonomics can lead to musculoskeletal disorders, such as repetitive strain injuries. Workers involved in repetitive or physically demanding tasks should have ergonomic workstations and receive training in proper posture and lifting techniques.

Heat and Cold Stress: Depending on the manufacturing process and location, workers may be exposed to extreme temperatures, leading to heat or cold stress. Adequate facilities, PPE, and training should be provided to mitigate these risks.

Fire and Explosion Hazards: Certain bio-based materials and manufacturing processes can create fire and explosion hazards. Proper storage, handling of flammable materials, and fire safety measures are essential to prevent accidents.

Electricity Hazards: Electrical equipment and wiring in manufacturing facilities pose a risk of electrical shock and fires. Regular maintenance, electrical safety training, and the use of appropriate protective equipment are vital.

Chemical Reactions and Reactor Safety: Some bio-based materials may require chemical reactions and the use of reactors. Ensuring the safe design and operation of these systems is crucial to prevent accidents and chemical exposures.

Material Handling and Storage: Improper handling and storage of raw materials and finished products can lead to accidents and health risks. Adequate training and safety procedures for material handling are essential.

Personal Protective Equipment (PPE): Workers should be provided with appropriate PPE, including gloves, goggles, respirators, and other safety gear, to protect them from specific hazards they may encounter in the manufacturing process.

Emergency Response and First Aid: Adequate training and access to first aid equipment should be available to address injuries and health emergencies promptly.

Worker Fatigue and Stress: Extended work hours and high-pressure work environments can lead to fatigue and stress-related health issues. Employers should monitor work hours, provide adequate breaks, and address stress factors in the workplace.

It's essential for employers in the manufacturing of novel bio-based materials to conduct comprehensive risk assessments, provide proper training, enforce safety protocols, and continually monitor and improve workplace safety to mitigate these concerns and protect the health and well-being of their workers.

5. OSH in the manufacturing of rubber panels

The manufacturing of rubber panels, in IIR o in SBR, for civil applications involves various occupational safety and health issues, which can vary depending on the specific processes and materials used. Some common issues and concerns in this manufacturing process include:

Chemical Exposure: Workers may be exposed to various chemicals used in rubber production, such as solvents, accelerators, and vulcanizing agents. Prolonged exposure can lead to skin irritation, respiratory problems, and other health issues.

Dust and Fumes: Rubber manufacturing processes can generate dust and fumes that may contain harmful particulate matter and chemical byproducts. Proper ventilation and respiratory protection are essential to reduce inhalation risks.

Noise Exposure: Machinery used in rubber panel manufacturing can produce high levels of noise, which can lead to hearing loss over time. Hearing protection and noise reduction measures are necessary.

Machine Safety: Workers who operate or maintain manufacturing machinery are at risk of injuries from moving parts, pinch points, and sharp tools. Proper training, machine guarding, and safety protocols are crucial to prevent accidents.

Ergonomics: Poor ergonomics in the workplace can lead to musculoskeletal disorders, particularly for workers involved in repetitive tasks. Proper workstations and ergonomic training are essential to prevent injuries.

Heat and Cold Stress: Depending on the manufacturing process and location, workers may be exposed to extreme temperatures, which can lead to heat or cold stress. Adequate facilities, PPE, and training are required to mitigate these risks.

Fire and Explosion Hazards: Certain rubber manufacturing processes, especially those involving the use of flammable solvents, can pose fire and explosion hazards. Proper storage, handling, and fire safety measures are essential.

Chemical Handling and Storage: Safe handling and storage of raw materials, including rubber compounds and chemicals, are critical to prevent spills, chemical exposures, and accidents.

Material Handling and Lifting: Improper handling and lifting of heavy rubber panels and materials can lead to musculoskeletal injuries. Training and safe lifting practices should be implemented.

Personal Protective Equipment (PPE): Workers should be provided with appropriate PPE, including gloves, goggles, respirators, hearing protection, and other safety gear, to protect them from specific hazards in the manufacturing process.

Emergency Response and First Aid: Adequate training, access to first aid equipment, and emergency response plans are crucial to address injuries and health emergencies promptly.

Worker Fatigue and Stress: Extended work hours and high-pressure work environments can lead to fatigue and stress-related health issues. Employers should monitor work hours, provide adequate breaks, and address stress factors in the workplace.

It's essential for employers in the manufacturing of rubber panels to conduct comprehensive risk assessments, provide proper training, enforce safety protocols, and continually monitor and improve workplace safety to mitigate these concerns and protect the health and well-being of their workers. Additionally, adherence to relevant safety standards and regulations is vital for ensuring a safe working environment in this industry.

6. OSH in the manufacturing of bioplastic bottle closures for the packaging of food and beverage sectors

For the bioplastic bottle closures manufacturing also, ensuring a safe and healthy work environment is not only a legal requirement but also crucial for the well-being of workers and the quality of the final product. Here are some specific OSH considerations for this manufacturing process:

Chemical Exposure and Handling: Bioplastic manufacturing may involve the use of chemicals, such as polymers and additives. Workers should be trained in the safe handling of these materials, including proper storage and disposal practices.

Dust and Airborne Particles: Manufacturing processes can generate dust and airborne particles. Workers must use appropriate respiratory protection and work in well-ventilated areas to minimize exposure.

Machine Safety: Workers operating machinery and equipment should receive training in machine safety, and machines should have appropriate safeguards to prevent accidents, such as guarding for moving parts.

Personal Protective Equipment (PPE): Workers should wear PPE, including gloves and eye protection, as necessary to protect against potential hazards during the manufacturing process.

Ergonomics: Ensure workstations and processes are designed ergonomically to reduce the risk of musculoskeletal disorders resulting from repetitive or awkward motions.

Heat Stress: Depending on the manufacturing environment, workers may be exposed to high temperatures. Adequate cooling measures and hydration options should be provided to prevent heat stress.

Food Safety regulation and Hygiene: In the context of food and beverage packaging, maintaining strict food safety and hygiene standards is essential. Workers should receive training in food safety practices to prevent contamination.

Noise Exposure: Noise from manufacturing equipment can be harmful to hearing. Implement hearing protection measures and noise reduction strategies in noisy areas.

Chemical Storage and Spill Control: Proper storage of chemicals and the availability of spill control measures are crucial to prevent accidents and chemical exposure.

Fire Safety: Manufacturing processes may involve flammable materials. Adequate fire safety measures, including fire extinguishers and evacuation plans, should be in place.

Waste Management: Safe handling and disposal of waste materials should be a priority to prevent environmental contamination and ensure worker safety.

Maintenance and Equipment Inspection: Regular maintenance and inspection of machinery and equipment are necessary to prevent sudden breakdowns and accidents.

Training and Education: Workers should receive training on OSH practices and food safety standards, including handling and storing bioplastic materials.

Emergency Response and First Aid: Adequate first aid equipment, trained personnel, and emergency response plans are essential for addressing workplace injuries and health emergencies.

Psychosocial Well-being: Consider the mental health and well-being of workers, as high-pressure or stressful work environments can lead to mental health issues. Provide support and resources for stress management and conflict resolution.

Compliance with relevant regulations and standards, including those specific to food and beverage packaging, is essential in the manufacturing of bioplastic bottle closures. Employers should conduct risk assessments, involve employees in safety programs, and continually monitor and improve OSH practices to create a safe and healthy work environment.

7. OSH in the manufacturing of wood composites to produce sliding bearings

Occupational safety and health (OSH) could be a critical concern also in the manufacturing of wood composites to produce sliding bearings. Workers involved in this process can be exposed to various hazards, and it's essential to implement safety measures to protect their well-being. Here are some specific OSH considerations for this manufacturing process:

Dust and Airborne Particles: Wood composite manufacturing can generate dust and fine airborne particles. Use local exhaust ventilation, dust collectors, and provide workers with respiratory protection as needed.

Machine Safety: Implement safety guards and emergency shutdown procedures on machinery and equipment to prevent accidents. Provide training to workers on safe machine operation and maintenance.

Personal Protective Equipment (PPE): Ensure that workers have access to and are using appropriate PPE, including safety goggles, gloves, dust masks, and hearing protection.

Noise Exposure: Machines used in wood composite manufacturing can generate high levels of noise. Conduct noise assessments, provide hearing protection, and implement noise reduction measures where necessary.

Chemical Exposure: Workers may be exposed to adhesives, resins, or other chemicals used in the wood composite manufacturing process. Store chemicals properly, provide safety data sheets, and ensure workers are trained in safe chemical handling.

Machine Maintenance and Safety Inspections: Regularly inspect and maintain equipment to prevent malfunctions and potential hazards. Establish a schedule for safety inspections.

Handling Heavy Materials: Workers may handle heavy wood materials and composite products. Ensure proper lifting techniques are used to prevent musculoskeletal injuries.

Ergonomics: Design workstations and processes to be ergonomically sound to reduce the risk of musculoskeletal disorders from repetitive or awkward movements.

Fire Safety: Implement fire prevention measures, including the availability of fire extinguishers, clearly marked emergency exits, and employee training in fire response procedures.

Waste Management: Properly store and dispose of waste materials, including hazardous waste, according to regulations. Provide spill containment materials and cleanup procedures for hazardous substances.

First Aid and Medical Response: Ensure first aid kits are available and regularly checked. Train personnel in first aid and emergency response procedures. Provide access to emergency medical services.

Psychosocial Well-being: Address workplace stress, harassment, and conflict resolution. Promote employee well-being programs and mental health support.

Safety Inspections and Reporting: Conduct regular safety inspections and encourage employees to report safety concerns and incidents. Ensure that a clear reporting mechanism is in place.

Documentation and Records: Maintain up-to-date safety-related documentation, including training records, incident reports, and safety policies.

Legal Compliance: Verify compliance with all relevant OSH regulations and standards, including those specific to wood manufacturing and composite production.

By addressing these OSH considerations, manufacturers can create a safer working environment for employees involved in the manufacturing of wood composites for sliding bearings. Regular training, monitoring, and improvements are essential to maintain workplace safety and protect the health and well-being of workers.

8. The assessment of OSH issues in the GREEN-LOOP value chains

The methodology for assessing Occupational Safety and Health (OSH) issues in the GREEN-LOOP manufacturing processes lead involve a systematic approach to identify and mitigate risks.

From M18, NSB will work on define the methodology and the action plan to delivered in the update Dev8.11 (M24).

Here are the main steps for conducting such assessments by the GREEN-LOOP partners:

1. Identify Stakeholders for each value chain: Identify the key stakeholders involved in the different manufacturing process, including workers, management, safety officers, and regulatory authorities.

2. Define Objectives: Clearly define the objectives of the OSH assessment, such as identifying hazards, ensuring compliance with regulations, and improving workplace safety.

3. Data Collection: Collect relevant data, including process documentation, incident reports if relevant, safety records, and information on materials, equipment, and machinery used.

4. Hazard Identification: Identify and assess potential hazards within the manufacturing process, including physical, chemical, biological, ergonomic, and psychosocial hazards. This can be done through observations, walkthroughs, and consultation with workers.

5. Risk Assessment: Evaluate the risks associated with identified hazards by considering factors such as the likelihood of occurrence, severity of consequences, and the number of exposed workers. This can help prioritize risks for mitigation.

6. Regulatory Compliance: Ensure that the manufacturing process complies with all relevant OSH regulations and standards. Review current regulations and verify compliance in all aspects.

7. Safety Measures and Controls: Identify existing safety measures and controls in place and assess their effectiveness. Determine if additional controls are required to mitigate risks.

8. Employee Involvement: Involve employees in the assessment process. Gather their insights, experiences, and feedback regarding OSH issues, as they are often most familiar with workplace hazards.

9. Data Analysis: Analyze the collected data and information to gain insights into trends, recurring incidents, and areas of improvement.

10. Prioritization: Prioritize identified hazards based on the risk assessment and regulatory compliance. Develop an action plan to address these issues, including control measures, timelines, and responsibilities.

11. Implementation of a plan: Execute the action plan and implement control measures, engineering solutions, administrative changes, or PPE to reduce or eliminate identified hazards.

12. Training and Education: Provide necessary training and education to employees, ensuring they are aware of the risks and know how to work safely.

13. Monitoring and Evaluation: monitor the effectiveness of implemented control measures and evaluate their impact on OSH. Adjust the action plan as needed.

14. Incident Reporting and Investigation: Establish clear incident reporting procedures and conduct thorough investigations to determine the root causes of incidents. Use the findings to improve safety measures.

15. Documentation and Record-Keeping: Maintain accurate records of the assessment process, action plans, training, incidents, and safety measures. Keep these records accessible for regulatory inspections and audits.

16. Communication: Ensure clear communication about OSH issues, safety policies, and incident reporting throughout the organization. This includes regular safety meetings and updates.

17. Review and Continuous Improvement: Periodically review the OSH assessment and action plans, making necessary adjustments based on changing processes, technology, regulations, and feedback from employees.

18. External Audits and Consultation: Seek external audits and consultation, when necessary, especially for complex manufacturing processes. Third-party experts can provide valuable insights and recommendations.

By following this comprehensive methodology, GREEN_LOOP partners will be in the condition to systematically assess and address OSH issues in manufacturing processes to create a safer and healthier workplace for employees while achieving compliance with regulations and improving overall operational efficiency.

A questionnaire has been developed and distributed to the relevant GREEN-LOOP partners involved in the three value chains to understand which grade of H&S is already implemented within their R&D activities.

Some references of the current standards applied from partners of the three value chains have been collected and included in the list of OSH regulations in the current Dev8.11 (M14).

Based on this feedback, a checklist for OSH issues has been prepared as an important step in ensuring the safety and well-being of workers in the GREEN-LOOP manufacturing processes.

To support the relevant GREEN-LOOP partner to verify and address the key OSH areas, a Check List on OSH issues for the GREEN-LOOP Manufacturing processes is delivered at month 14 (Annex 2).

This practical tool will be updated at month 24 and at month 36 If relevant.

9. Gender and Diversity Dimensions in OSH

The GREEN-LOOP project aims to set an example in the treatment and integration of gender sensitivity and ethical issues (T8.5). In this context, occupational safety and health (OSH) aspects in the GREEN-LOOP project also need to include gender and diversity dimensions.

Due to biological differences and social structures that codetermine working conditions, women and men face different risks at work (EU-OSHA 2016).

To fully promote occupational safety and health (OSH) for all employees, diversity and gender issues need to be included by using a gender-sensitive, intersectional and holistic approach (EU-OSHA 2016). That means including gender dimensions into OSH, looking at the intersection of multiple categories, identifying vulnerable groups and take into account diversity aspects.

In order to avoid any form of discrimination, the GREEN-LOOP consortium should consider gender differences and diversity aspects in the development of OSH policies and prevention strategies.

To ensure the integration of gender and diversity dimensions in OSH issues, this document contains a summary of the literature review carried out by AAU on gender aspects in OSH and a checklist to support the integration of gender and diversity dimensions in the GREEN-LOOP project. The checklist (Annex 3) is based on a literature review and does not have a claim to be exhaustive. It focuses on aspects that are relevant to the GREEN-LOOP activities and can be expanded at any time during the project lifetime if necessary.

Data

When it comes to OSH, the data that has been collected often includes only men as being representative of the population as a whole. Consequently, there is a data gap on women and OSH (Criado-Perez 2019; Biswas et al. 2021; Weber/Henke 2014).

In this respect, it is particularly important to collect data not only for men, but also to include women equally in studies. In addition, data should always be disaggregated by sex and presented transparently in order to identify any differences between women and men in OSH.

When referring to existing studies, it is important to check whether the data are gender-specific and have been transparently disaggregated by sex. This ensures that occupational exposure limits apply equally to women and are not based solely on male data.

While the data show that men are more likely to die from fatal accidents at work, occupational cancer is just as common a cause of death.

Breast cancer rates have increased significantly over the past 50 years, particularly in industrialized countries. There is evidence that breast cancer in women is associated with occupational exposure to chemicals, ionizing radiation and circadian disruption (Brophy et al. 2012; Brito-Marcelino et al. 2020). However, due to a lack of data and the long latency period of cancers, it can take decades before conclusions can be drawn (APHA 2014). In addition, it is difficult to establish a causal link between breast cancer and occupational risks, as breast cancer can be caused by a number of variables (Brito-Marcelino et al. 2020).

Nonetheless, most studies and regulations, based on this data, refer to the average white male and exclude all people who do not conform to this average type. It is, therefore, very important to adopt a gender-sensitive approach when collecting data, conducting surveys or carrying out studies: “To advance occupational exposure and health research, future studies should focus on understanding occupation-

specific gender/sex segregation within occupational hazard exposures as these are likely to be perceived as modifiable targets for prevention practices and policies than if only male- or female-centric exposure differences across occupations were described" (Biswas et al. 2021: 276)

Biological Differences

In most EU Member States, there are almost as many women as men in employment (Eurostat 2023). However, occupational safety and health measures are still based on the average white male norm. Not only can this cause problems for any person who deviates from this norm, but it makes the working environment more dangerous, e. g. for women.

Owing to distinct physiques and biological variations between women and men, the risks to which they are exposed differ significantly.

This is case, for example, with personal protective equipment (PPE) "as most of the PPE is based on the sizes and characteristics of male populations from certain countries in Europe and the United States" (TUC 2017: 4). Furthermore, "much of the available data were collected in the 1950s and 1970s from military personnel and the general population from that era. These decades-old data do not represent, on average and collectively, the sizes and body types of today's workers, who are much more diverse in age, gender, and ethnicity" (Hsiao 2015).

"As a result, most women and also many men, experience problems finding suitable and comfortable PPE because they do not conform to this standard male worker model" (TUC 2017: 4).

Consequently, women find their PPE uncomfortable, are less protected by PPE and more exposed to work hazards, and at times, even perceive PPE as a hindrance to their work. For instance, 57% of women respondents in a 2016 survey on PPE found that their PPE sometimes or significantly hampered their work (TUC 2017: 4).

The design of PPE must be gender-sensitive and inclusive, which means that adopting asimplistic approach of using smaller sizes is not sufficient. In order to design appropriate and safe PPE for women, there are a number of anthropometric characteristics of women that need to be taken into account (Hsiao 2015; TUC 2017; Fischer 2020; Oo/Lim 2020).

For instance, when it comes to (protective) work wear, only reducing the size of the standard garments still results in ill-fitting garments for women. Not only are women on average smaller than men, they also have different physical traits that need to be taken into account when designing PPE .

For example, "Jackets designed for men are longer and larger than those made for women. The waist cut design is higher for women, and there's more space in the chest area. The shoulders on men's jackets are much broader compared with women's jackets" (Fischer 2020).

Or, to give another example: "An analysis of chemical protective gloves has shown that gloves designed to fit the smallest 5% of men would be too big for half of the female population" (Arbuckle 2006). Further examples can be found in the TUC report (2017).

It is essential to design PPE that matches the physiological characteristics of women and not only sizing down the male versions. This applies to everything else that is considered as PPE, such as machines, tools, or vehicles.

Biological variations should also be considered, when considering chemical exposure. Differences in the immune and endocrine systems between women and men should be considered in risk assessment activities, as there are often discrepancies between the levels of exposure for women and men.

For example, women are on average shorter, have thinner skin and a higher percentage of body fat than men (Arbuckle 2006).

Furthermore, in the risk assessment for establishing safe thresholds, it is imperative to account for the presence of both mixed toxicity and endocrine-disrupting chemicals. The level of toxicity risk cannot be solely quantified by volume since toxic effects can occur at low doses (Vahter et al. 2007; APHA 2014: 244 f.). Of further importance, is the consideration of variations between women and men in the transport and distribution of chemicals to different parts of the body (Arbuckle 2006).

Pregnant women are considered a particularly vulnerable group and should, therefore, be given special consideration in workplace risk assessments. Not only can work-related risks pose a danger to the unborn child, but the risks to the pregnant woman herself can be increased due to altered hormone levels and physical changes (Vahter et al. 2007; ILO 2013: 9; EU-OSHA 2016: 40).

In general, however, it is important to pay special attention to reproductive health, not only for women but also for men (ILO 2013; EU-OSHA 2003b), because “there are many workplace hazards that can affect the reproductive health of both sexes and their offspring. These include chemical, biological and physical hazards including pesticides, metals, dyes and solvents; noise and vibration; radiation; and infectious diseases” (ILO 2013: 10).

In sum, it is of paramount importance that appropriate OSH measures are put in place to create a safe and healthy workplace for everyone.

Gender Differences

It is not only biological differences that expose women and men to sex-specific risks; gender dimensions also play an important role in OSH issues. The working lives of women and men differ in many ways: “Socially constructed gender roles and expectations include differences in the types of occupations and industries in which men and women work, their duties and responsibilities within these occupations and industries, and their engagement in the labor force in general” (Biswas et al 2021: 267).

In terms of gender, women and men are exposed to different physical and psychological risks which are caused by social structures such as gender roles, occupational segregation, horizontal and vertical segregation, so that gender differences even play a role within occupations and workplaces (Biswas et al. 2021).

Particularly in male-dominated professions, OSH studies often treat women as a disruptive factor, while in female-dominated professions such studies have not even been carried out (Criado-Perez 2019).

Even though there are still male- and female-dominated sectors, “women's move into traditional male jobs has also been slowly increasing. The most recent edition of the EWCS demonstrates that there are more women working in male-dominated jobs than there are men working in traditionally female-dominated sectors. However, research from the USA shows that 'new' occupations in which women choose to work may not necessarily have the required preventions in place to reduce the risks that women face at the workplace” (EU-OSHA 2016: 15).

The bulk of unpaid care work continues to be borne by women, which contributes to their higher likelihood, compared to men, of being engaged in precarious and part-time employment. This leads, for example, to greater risks for women in such employment relationships because “they tend to have fewer training opportunities and less control over their work. Their opportunities to participate in the company's decision-making process are more limited and they have less access to OSH preventive services” (Weber/Henke 2014).

As a result, women often get overlooked in workplace risk assessment and when it comes to the development of OSH prevention measures.

Gender dimensions also need to be taken into account when it comes to exposure to hazardous substances. Women and men have different personal and working environments and thus different exposures to chemicals (EU-OSHA 2003a; Arbuckle 2006).

Women are more likely to work in part-time jobs, which expose them to occupational risks, but for fewer hours. At the same time, they still do much of the unpaid work, where work hazards are much less understood (Vahter et al. 2007). Due to a lack of research and existing gender perceptions/prejudices, female-dominated occupations are often considered safer (Biswas et al. 2021: 276). However, this is far from the reality of many women's working lives, where physical as well as mental stress is part of their daily work. In health care, for example, women “are exposed to hazardous exposures, including physical violence and biomechanical strain that result from patient handling” (Biswas et al. 2021: 276).

Moreover, the risk assessment should account for variations in exposure levels within the same occupation, attributable to the segregation of tasks by gender. It should also consider the accumulation of chemicals due to gender-specific lifestyles. Even within the same job title, the acute occupational exposure can differ between men and women (Arbuckle 2006).

Additionally, risk assessments should incorporate the intersection of various social categories and the specific risks arising from their overlap. For example, the jobs women do are strongly depended on their age or ethnicity which leads to different OSH risk factors for specific occupational groups (Weber/Henke 2014; EU-OSHA 2016: 7).

For OSH policies and prevention strategies to be effective for both, women and men, diversity and gender dimensions must to be taken into account.

Although sex and gender are analysed separately here, this should not obscure the fact that in reality both dimensions interact and influence each other.

OSH in the EU and risk and trends related to Gender

The baseline for the legislation on gender in OSH is set by the EU with the "Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work" (the so-called "Framework Directive") and its amendments of 2003, 2007 and 2008, among other directives.

Although the EU has long taken a 'gender-neutral' approach, gender differences are now seen as central to adequate OSH (Matsuura 2022). Legislation addresses equal opportunities, treatment and pay for men and women, social security, working conditions, harassment, maternity, paternity, parental and carer's leave and flexible working arrangements for workers with young children and other carers (International Labour Organization 2021).

Furthermore, in the EU's "Strategic Framework on Health and Safety at Work 2021-2027" encourages action against gender bias in risk assessment through "(i) gender representation in consultations of workers; (ii) training adapted to employees' personal situation; and (iii) the recognition of risks in occupations that have long been overlooked or considered as 'light work' (e.g. carers or cleaners)" (European Commission 2021: 13).

The European Agency for Safety and Health at Work (EU-OSHA) is responsible for making Europe's workplaces safer, healthier and more productive. As a part of this, it regularly publishes the European Survey of Enterprises on New and Emerging Risks (ESENER), which looks at how European workplaces manage safety and health risks in practice. Sex and gender issues are not included into the report (Howard et al. 2022). Information, factsheets and related publications can be found on the EU-OSHA’s website (Women and safety and health at work | Safety and health at work EU-OSHA (europa.eu)), where they are defined as follows:

"The key aim is to help ensure that gender-related issues are taken into account when policies and decisions are made in the workplace and at EU level. EU-OSHA actively researches risks and trends related to gender".

10. Literature

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Annex 1 - Survey on Health and Safety conditions of GREEN-LOOP manufacture systems

This is a questionnaire for a survey to be sent to the relevant GREEN LOOP partners in order to collect input to elaborate an initial version of GREEN-LOOP health and safety conditions report to be delivered at the end of October 2023 (Month 14 of project implementation).

NSB is responsible for deliverable 8.11 'Report on Occupational Safety and Health in GREEN-LOOP production systems', which will include relevant health and safety issues and a documentary analysis of the guidelines and standards that ensure the health and safety of all workers.

In addition, collaborating with ISQ, NSB will facilitate the results of this survey for T8.4 Training and Social Engagement (task leader: ISQ), focusing on the training needs of workers regarding the technologies developed in the GREEN-LOOP project for the three identified value chains.

The joint effort of all technical partners involved in the implementation of the GREEN-LOOP solutions will enable the development of effective guidelines and training.

To be sent to the partners by 7th August 2023 - Deadline: 9th September 2023

* Indicates required question

Email*

Partner's Name*

Part 1 - European and/or national directives and standards for health and safety in the workplace.

a) **With regard to the production processes developed or validated in the GREEN-LOOP project, which of the following international occupational safety legislation or standards is relevant to your organisation?** *

Law/Standard	Year	Description	Yea/No
EN 12433-1:1999	1999	Industrial, commercial and garage doors and gates - Terminology - Part 1: Types of doors	
EN 12433-2:1999.	1999	Industrial, commercial and garage doors and gates - Terminology - Part 2: Parts of doors	
EN 1363-1:2020	2020	Fire resistance tests - Part 1: General Requirements	
EN 1363-2:1999	1999	Fire resistance tests - Part 2: Alternative and additional procedures	
EN 13501-1:2018	2018	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests	
EN 13501-2:2016	2016	Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services	
EN 3-7:2004+A1:2007	2007	Portable fire extinguishers - Part 7: Characteristics, performance requirements and test methods	
EN 12845:2015+A1:2019	2019	Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance	
EN 16798-3:2017	2017	Energy performance of buildings - Ventilation for buildings - Part 3: For non-residential buildings - Performance requirements for ventilation and room-conditioning systems (Modules M5-1, M5-4)	
EN 16798-1:2019	2019	Energy performance of buildings - Ventilation for buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics - Module M1-6	
ISO 10551:2019 EN ISO 10551:2019	2019	Ergonomics of the physical environment — Subjective judgement scales for assessing physical environments	
ISO 7730:2005 EN ISO 7730:2005	2005	Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria (ISO 7730:2005)	
EN 12464-1:2021	2021	Light and lighting - Lighting of workplaces - Part 1: Indoor workplaces	

Is there a national occupational safety legislation relevant to your organisation that was not mentioned in the list above?

If yes, please describe it_____

b) With regard to the production processes developed or validated in the GREEN-LOOP project, which of the following legislation or standards for machinery is relevant to your organisation? *

Law/Standard	Year	Description	Yea/No
ISO 6385:2016 EN ISO 6385:2016	2016	Ergonomics principles in the design of work systems (ISO 6385:2016)	
ISO 12100: 2010 EN ISO 12100:2010	2010	Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)	
EN IEC 60900:2018/AC:2020-05 IEC 60900:2018/COR2:2020	2020	Live working - Hand tools for use up to 1 000 V AC and 1 500 V DC	
EN 60745-2-3:2011/A13:2015	2015	Hand-held motor-operated electric tools - Safety - Part 2-3: Particular requirements for grinders, polishers and disk-type sanders	
ISO 13849-1:2015 EN ISO 13849-1:2015	2015	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)	
ISO 14120:2015) EN ISO 14120:2015	2015	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)	
ISO 14119:2013(Idéntico) EN ISO 14119:2013	2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection (ISO 14119:2013)	
EN 60529:1991 EN 60529:1991/corrigendum May 1993 IEC 60529:1989	1993	Degrees of protection provided by enclosures (IP Code)	

EN ISO 13850:2015 ISO 13850:2015	2015	Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)	
EN ISO 13855:2010 ISO 13855:2010	2010	Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)	
ISO 13856-1:2013 EN ISO 13856-1:2013	2013	Seguridad de las máquinas. Dispositivos de protección sensibles a la presión. Parte 1: Principios generales para el diseño y ensayo de alfombras y suelos sensibles a la presión. (ISO 13856-1:2013).	
ISO 13856-2:2013 EN ISO 13856-2:2013	2013	Safety of machinery - Pressure-sensitive protective devices - Part 2: General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars (ISO 13856-2:2013)	
ISO 13857:2019 EN ISO 13857:2019	2019	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)	
EN 61496-1:2013/AC:2015 IEC 61496-1:2012/COR1:2015	2015	Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests	
ISO 13851:2019 EN ISO 13851:2019	2019	Safety of machinery - Two-hand control devices - Principles for design and selection (ISO 13851:2019)	
EN 60204-1:2018 IEC 60204-1:2016	2018// 2016	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	
EN IEC 60204-11:2019 IEC 60204-11:2018	2019//2018	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 Kv	
ISO 4413:2010 EN ISO 4413:2010	2010	Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)	
ISO 4414:2010 EN ISO 4414:2010	2010	Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010)	

ISO 13732-1:2006 EN ISO 13732-1:2008	2006//2008	Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)	
ISO 13732-3:2005 EN ISO 13732-3:2008	2005//2008	Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 3: Cold surfaces (ISO 13732-3:2005)	
EN ISO 19353:2019 ISO 19353:2019	2019	Safety of machinery - Fire prevention and fire protection (ISO 19353:2019)	
EN 1127-1:2019	2019	Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology	
ISO/TR 11688-1:1995 EN ISO 11688-1:2009)	1995//2009	Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1:1995)	
EN 847-1:2017	2017	Tools for woodworking - Safety requirements - Part 1: Milling tools, circular saw blades	
EN 12096:1997	1997	MECHANICAL VIBRATION. DECLARATION AND VERIFICATION OF VIBRATION EMISSION VALUES.	
EN ISO 4871:1996 ISO 4871:2009	1996//2009	Acoustics - Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)	
ISO 3691-1:2011/Amd 1:2020 EN ISO 3691-1:2015/ 1:2020	2020	Industrial trucks - Safety requirements and verification - Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks - Amendment 1 (ISO 3691-1:2011/Amd 1:2020)	
ISO 6055:2004	2004	Industrial trucks. Overhead guards. Specification and testing. (ISO 6055:2004)	
ISO 5057:1993	1993	INDUSTRIAL TRUCKS. INSPECTION AND REPAIR OF FORK ARMS IN SERVICE ON FORK-LIFT TRUCKS.	
EN 1175:2020	2020	Safety of industrial trucks - Electrical/electronic requirements	

ISO 3691-2:2016 EN ISO 3691-2/AC::2016	2016	Industrial trucks - Safety requirements and verification - Part 2: Self-propelled variable-reach trucks (ISO 3691-2:2016)	
ISO 3691-4:2020 EN ISO 3691-4:2020	2020	Industrial trucks - Safety requirements and verification - Part 4: Driverless industrial trucks and their systems (ISO 3691-4:2020)	
EN 1755:2015	2015	Industrial Trucks - Safety requirements and verification - Supplementary requirements for operation in potentially explosive atmospheres	
ISO 5053-1:2015	2015	Powered industrial trucks.Terminology and classification. Part 1: Types of industrial trucks	
EN 15011:2020	2020	Cranes - Bridge and gantry cranes	
		Cranes. Inspections. Part 5: Bridge and gantry cranes	
EN 60204-32:2008 IEC 60204-32:2008	2008	Safety of machinery - Electrical equipment of machines -- Part 32: Requirements for hoisting machines	

Is there a national occupational safety legislation relevant to your organisation that was not mentioned in the list above?

If yes, please describe it_____

c) With regard to the production processes developed or validated in the GREEN-LOOP project, which of the following legislation or standards for protection equipment is relevant to your organisation? *

Document	Year	Description	Yes/No
ISO 21420:2020 EN ISO 21420:2020	2020	Protective gloves - General requirements and test methods (ISO 21420:2020)	
EN 388:2016+A1:2018	2018	Protective gloves against mechanical risks	
ISO 374-1:2016 EN ISO374-1:2016	2016	Protective gloves against dangerous chemicals and micro-organisms - Part1: Terminology and performance requirements for chemical risks	

ISO 374-2:2019 EN ISO374-2:2019	2019	Protective gloves against dangerous chemicals and micro-organisms - Part2: Determination of resistance to penetration (ISO 374-2:2019)	
EN 166:2001	2001	Personal eye- protection	
ISO 16972:2020 EN ISO16972:2020	2020	Respiratory protective devices - Vocabulary and graphical symbols (ISO 16972-2020)	
EN 405:2001+A1:2009	2009	Respiratory protective devices - Valved filtering half masks to protect against gases andgases and particles- Requeriments, testing, marking	
EN 136:1998/AC:1999 EN 136:1998/AC:2003	1999-2003	Respiratory protective devices - Full face masks - Requeriments, testing, marking	
ISO 13688:2013 EN ISO 13688:2013	2013	Protecting clothing - General requiriments (ISO 13688:2013)	
ISO 13688:2013/Amd 1:2021 EN ISO 13688:2013/A1:2021	2021	Protecting clothing - General requirements - Amendment 1 (ISO 13688:2013/Amd1:2021)	
ISO 20345:2011 EN ISO 20345:2011	2011	Personal protective equipment - Safety footwear (ISO 20345:2011)	
EN 352-1:2020	2020	Hearing protectors - General requirements - Part 1: Earmuffs	
EN 352-2:2002	2002	Hearing protectors - General requirements - Part 2: Ear - plugs	
EN 397:2012+A1:2012	2012	Industrial safety helmets	
EN 361:2002	2002	Personal protective equipment - against fallsfrom a height - Full body harnesses	

Is there a national occupational safety legislation relevant to your organisation that was not mentioned in the list above?

If yes, please describe it_____

Part 2 - Other requirements or standards for health and safety of the workers.

a) **With regard to the production processes developed or validated in the GREEN-LOOP project, are there other 'essential requirements' to ensure a high level of protection of health and safety of the workers?** *

YES / NO

If "Yes", please describe it_____

b) **The use of most standards remains voluntary. Alternative standards are possible, but manufacturers are obliged to demonstrate that their products meet the essential requirements. Are there alternative standards adopted by your organisation?** *

YES / NO

If "Yes", please describe it_____

Part 3 – Training needs for health and safety of the workers.

c) **a) With regard to the production processes developed or validated in the GREEN-LOOP project, are there any relevant training needs to ensure a high level of health and safety protection for workers?** *

YES / NO

If 'Yes', please describe what relevant training needs the GREEN-LOOP project must fulfil.

_____

Annex 2 - Checklist for Occupational Safety and Health (OSH) issues for GREEN-LOOP manufacturing processes

Dear GREEN-LOOP partner, this checklist covers key OSH areas to be verified and addressed.

Please adapt and expand upon it as necessary to suit the specific processes and risks associated with your manufacturing operations:

Occupational Safety and Health (OSH) Checklist for EU or UK using the GREEN-LOOP manufacturing processes	**Check (and comment if relevant)**
General Safety and Health Measures:	
Verify that there is a designated OSH manager or responsible personnel in charge of safety at the facility.	
Ensure that all employees have received OSH training, and their training records are up to date.	
Confirm the availability and accessibility of safety data sheets (SDS) for all chemicals and materials used in the manufacturing process.	
Chemical and Biological Hazards:	
Verify that all hazardous chemicals and biological agents used in the manufacturing process are properly labeled.	
Ensure proper storage and handling of hazardous chemicals, including compatibility and separation requirements.	
Confirm that workers are using appropriate personal protective equipment (PPE) when handling hazardous substances.	
Check for proper ventilation and control measures to reduce chemical exposure, including fume hoods or local exhaust systems.	
Ensure that employees are trained in emergency response procedures for chemical spills or releases.	
Machine Safety:	
Verify that all machinery and equipment have safety guards and emergency shutdown procedures.	
Check that workers have received training in machine safety and lockout/tagout procedures.	
Confirm that equipment is regularly inspected and maintained to prevent accidents.	
Ensure that equipment installation and setup follow safety guidelines.	
Ergonomics:	
Verify that workstations and tasks are designed ergonomically to reduce the risk of musculoskeletal disorders.	
Confirm that employees receive training in proper lifting and ergonomic practices.	
Address any concerns related to repetitive tasks and make necessary ergonomic adjustments.	
Noise and Vibration:	

Ensure noise levels are within acceptable limits, and if not, provide hearing protection as required.	
Verify that workers have access to noise reduction measures, such as sound barriers or acoustic enclosures.	
Fire Safety:	
Confirm the presence of fire extinguishers and other fire safety equipment.	
Check that fire exits are clearly marked and unobstructed.	
Ensure that employees are trained in fire evacuation procedures and know how to use fire-fighting equipment.	
Waste Management:	
Verify that waste materials, including hazardous waste, are properly labeled, stored, and disposed of in accordance with regulations.	
Confirm the availability of spill containment and cleanup materials for hazardous materials.	
First Aid and Medical Response:	
Verify that first aid kits are available and regularly checked.	
Ensure that personnel are trained in first aid and emergency response procedures.	
Confirm access to emergency medical services and contact information.	
Psychosocial Well-being:	
Promote a positive workplace culture that addresses stress, harassment, and conflict resolution.	
Encourage employee well-being programs, stress management resources, and mental health support.	
Safety Inspections and Reporting:	
Regularly conduct safety inspections and audits of the facility.	
Establish a clear reporting mechanism for employees to raise safety concerns and incidents.	
Documentation and Records:	
Ensure that all safety-related documentation, including training records, incident reports, and safety policies, are up to date and readily accessible.	
Legal Compliance:	
Verify compliance with all relevant EU / UK and national OSH regulations and standards.	
Regularly reviewing and updating this checklist is essential to maintaining a safe and healthy working environment in the manufacturing of novel bio-based materials. Additionally, consult with OSH professionals or regulatory authorities to ensure full compliance with current regulations and industry best practices.	

Annex 3 - Checklist for Gender and Diversity Dimensions in OSH

Data	Yes	No
If data collected, is it disaggregated by sex?	o	o
Is the gender dimension included in the data collection (e. g. adjustment for hours of work and differences in the acute occupational exposure)?	o	o
Are possible intersections of different social categories (i.e. sex, gender, age, socio-economic status, etc.) assessed?	o	o
Are women and men equally represented in surveys – as far as possible – to close the gender data gap?	o	o
Is the data collected anonymously to avoid any potential biases?	o	o
Does the data collection assess differences between different occupations/tasks (gender norms/roles)? *What are the risks of male or female dominated occupations? Have all risks been considered?*	o	o
Does the data collection assess differences in the same occupation? *Are certain social groups at higher risk? Are they differently affected by risks due to biological or gender differences?*	o	o
Are there any studies available that relate to your own OSH policy or strategy?	o	o

Risk assessment	Yes	No
Does the risk assessment take into account sex dimensions by considering differences in the immune, pain and hormonal systems, biological and physical characteristics?	o	o
Does the risk assessment take into account differing references values and risk levels for different social groups (not only using the average white male standard for everybody)?	o	o
Does the risk assessment consider the actual exposure of all affected groups?	o	o
Are all the environments where chemicals occur considered, including mixed toxicity and endocrine disruptors?	o	o
Is pregnancy taken into account? Consider the potential differential effects on pregnant individuals in terms of hormonal and physical changes and on the unborn child.	o	o
Does the risk assessment take gender dimensions into account? *This should include the intersection of several social categories and specific risks that occur for women because of gender roles.*	o	o
To avoid any bias, have you checked your prior assumptions about what the hazards are and who is at risk? *Also check for any (gender) bias in prioritizing risks according to high, medium and low.*	o	o
Have you ensured that instruments and tools used for assessment include issues relevant to both male and female employees?	o	o

Protective clothing and equipment	Yes	No
Is occupational safety and health for women equally included in (male-dominated) occupations and not only as a divergence from the male norm?	○	○
Is the personal protective equipment also designed for women and everybody, who does not match the average white male norm? *This includes not only smaller versions of the equipment of the male standard, but adjustments to the physical, biological and social needs of women and other social groups.*	○	○
Are working tools and devices suitable for the ergonomic needs of women and other people diverging from the male standard?	○	○
Is it ensured, that part-time personnel have sufficient access to training opportunities, especially on OSH issues related to their specific tasks?	○	○

General measures to promote gender-sensitivity in OSH
Reviewing safety policies, specifically including a commitment to gender mainstreaming, and relevant objectives and procedures.
If possible, enable flexible working hours to facilitate the reconciliation of profession and (care) work at home.
Ensure that women also have the opportunity to participate in the company's OSH decision-making processes and implementation of solutions.
Promote a culture of reporting and recording on OSH issues and accidents, so that potential OSH risks are not get overlooked.
Incorporate sexual harassment reporting into OSH and implement policies to prevent sexual harassment.