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Safety & Fire Risk Identification in the Emerging Lithium Battery Value Chain

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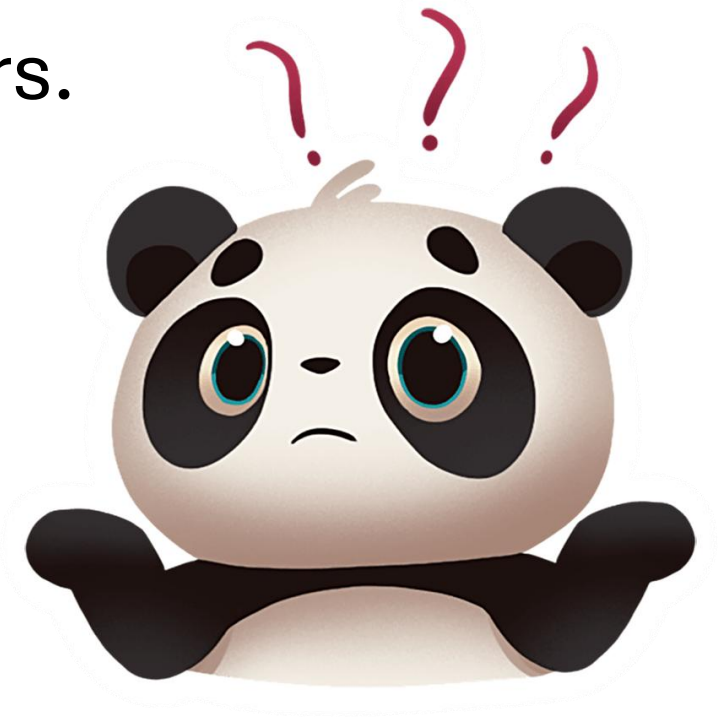


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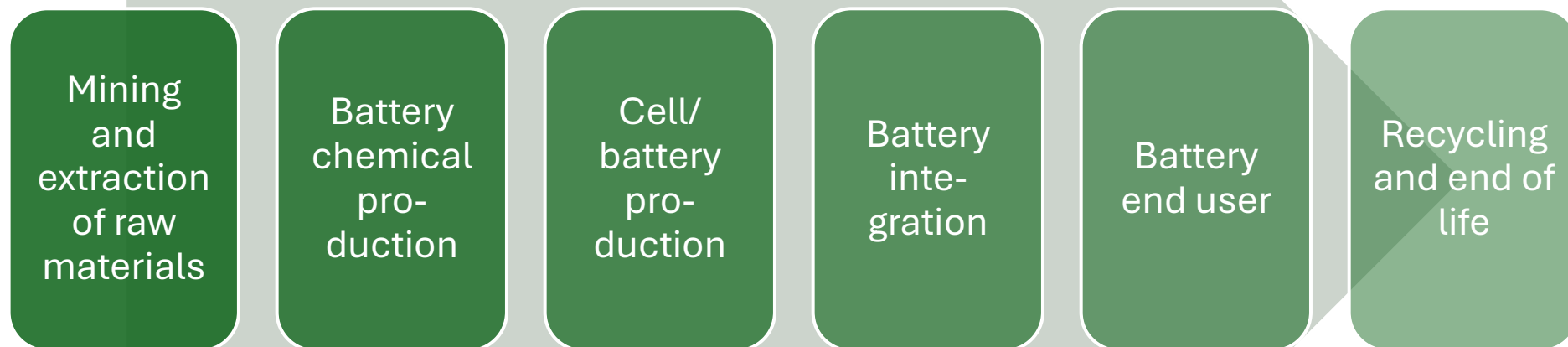


Demand for Li-ion batteries is growing

- An increasing number of people are working with batteries, either in their production chain or as end users.
- Is their work safe?

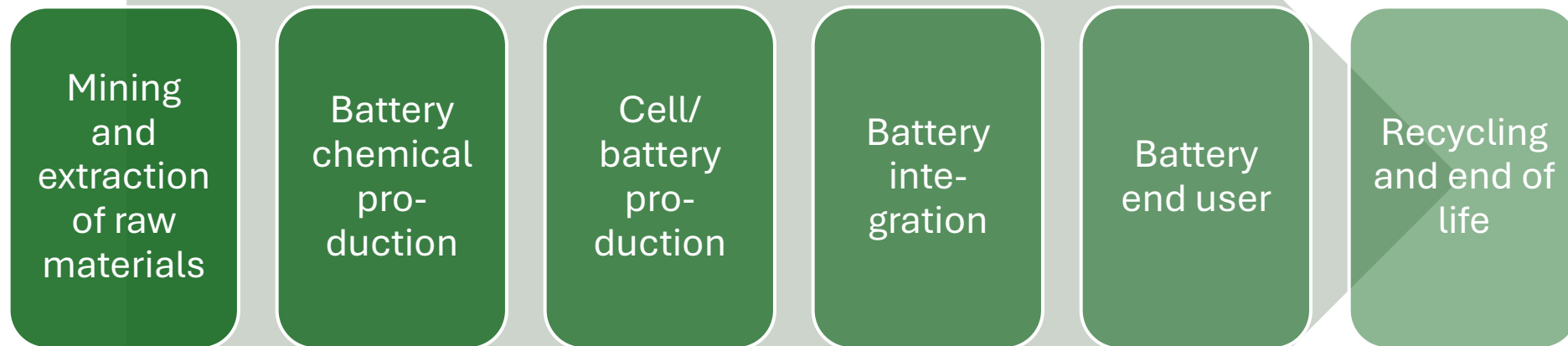


Li-ion battery value chain



Li-ion battery value chain

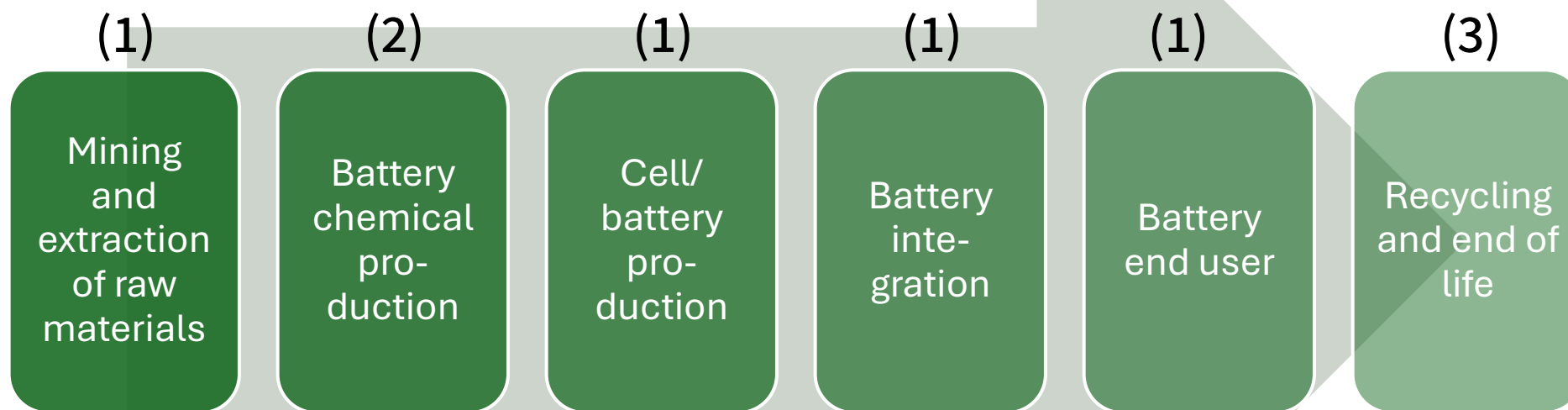
Normal conditions & Accidental events



- Hazardous materials
- Hazardous material releases (leakages, process emissions)
- Occupational/industrial accident risks

Li-ion battery value chain

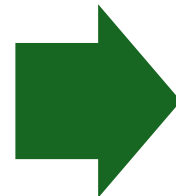
Studied Companies



- Literature review of occupational safety risks
- Semi-structured interviews
- Hazard assessment
- Document analysis (concentrations of air impurities, biomonitoring data)

Occupational Safety Risks

Mining and extraction of
raw materials



Chemical Exposure (Ni, Co)
Electrical Hazard
Fire Hazards

Battery chemical
production



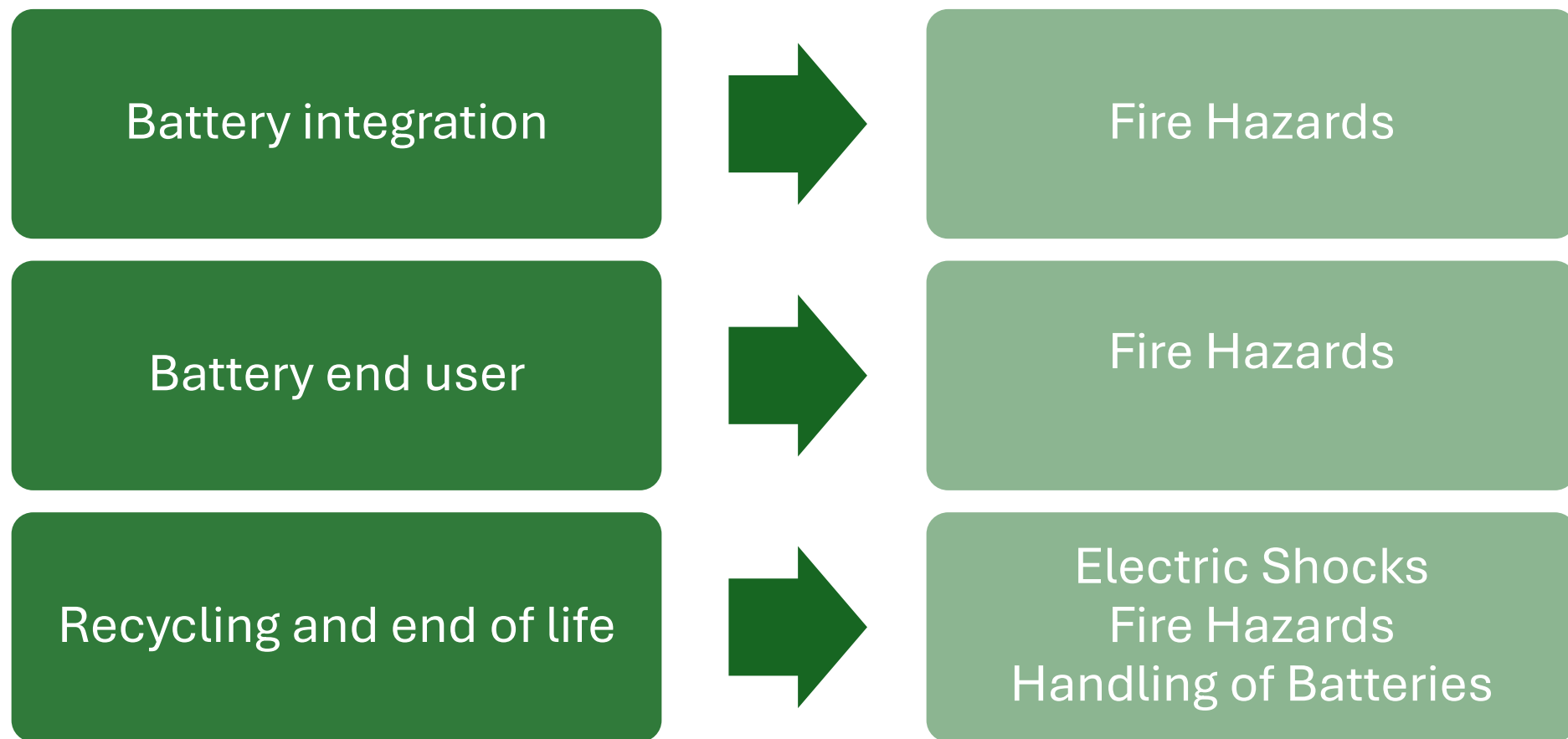
Chemical Exposure, dusts
Fire Hazards

Cell/
battery production



Accident risks

Occupational Safety Risks



Li-ion battery fire

Exposure agents

Toxic gases	CO, Hydrogen Fluoride, Hydrogen cyanide, Phosphoryl fluoride, Phosphorus pentafluoride
Flammable gases	Hydrogen, Methane, Ethylene, Propene
Irritant compounds	Hydrogen Chloride, Acrolein, Formaldehyde, VOCs, NO _x
Corrosive compounds	Hydrofluoric Acid, Phosphoric Acid, Lithium hydroxide
Particulate Matter	Smoke, Soot (PAH), Metals (Al, Ni, Mn, Co, Li)



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Conclusions

- Several occupational safety risks were identified through out the Li-ion battery value chain.
- Good RA practices are in use, especially in the first phases of the value chain.
- Transfer of safety information between different phases and actors should be improved.
- More studies are needed, also for other battery types, to protect workers' health and safety.



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Conclusions

- Batteries pose a fire hazard which may lead to (occupational) exposure to harmful chemicals.
- Close cooperation with fire and rescue authorities is needed to protect workers and citizens.
- **Battery safety should be included to the risk assessment.**



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Reference & Further reading

- Lithium-ion battery's life cycle: safety risks and risk management at workplaces. FINAL REPORT OF THE RESEARCH PROJECT. ISBN 978-952-391-040-9 (pdf).
<https://www.julkari.fi/server/api/core/bitstreams/248d9571-1c71-462e-a32e-5ec4c4bc134e/content>
- <https://www.ttl.fi/en/research/projects/exposure-operation-and-protection-in-li-battery-fires-battery-fire-project>



Acknowledgements

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