

CANCER RISK FROM HEAVY METAL EXPOSURE IN RECYCLING WASTE OF ELECTRICAL AND ELECTRONIC EQUIPMENT: PRELIMINARY RESULTS FROM THE WEEENMODELS EUROPEAN LIFE PROGRAM



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Background and objectives



When electrical and electronic equipments reach their end of life, they are defined as Waste Electrical and Electronic Equipment (WEEE). The aim of the WEEENSMODELS European Life Program, funded by the financial instrument LIFE +, is to create a new model of WEEEs management.

Numerous are the sources of e-wastes among everyday consumer or industrial items. Global e-waste generation was estimated to be 41.8 million tonnes in 2014 and may increase to 65.4 million tonnes by 2017, leading e-waste to be the fastest growing source of waste worldwide. The growing amount of this type of waste has posed significant challenges to waste management in both developed and developing countries, since WEEE contain a whole range of toxic chemicals having relevant environmental implications and possibly affecting human health, both of the general population and of the workers employed in recycling and reusing activities.

Among the potential health consequences associated with exposure to e-waste toxic chemicals reported in scientific literature, different effects have been highlighted, such as changes in lung and thyroid function, hormonal and endocrine dysregulation, neurobehavioral effects, spontaneous abortions and other adverse reproductive effects, genotoxic and carcinogenic effects.

The WEEE life cycle may expose the general population and workers to various toxic chemicals, such as heavy metals. We conducted a health risk assessment to evaluate the cancer risk derived from environmental and occupational exposure to trace elements from different recycling procedures, such as electronic scrap in blister copper, treatment of metals recovery in copper smelter, treatment of shredding and pyrometallurgical treatment of Li-ion battery.

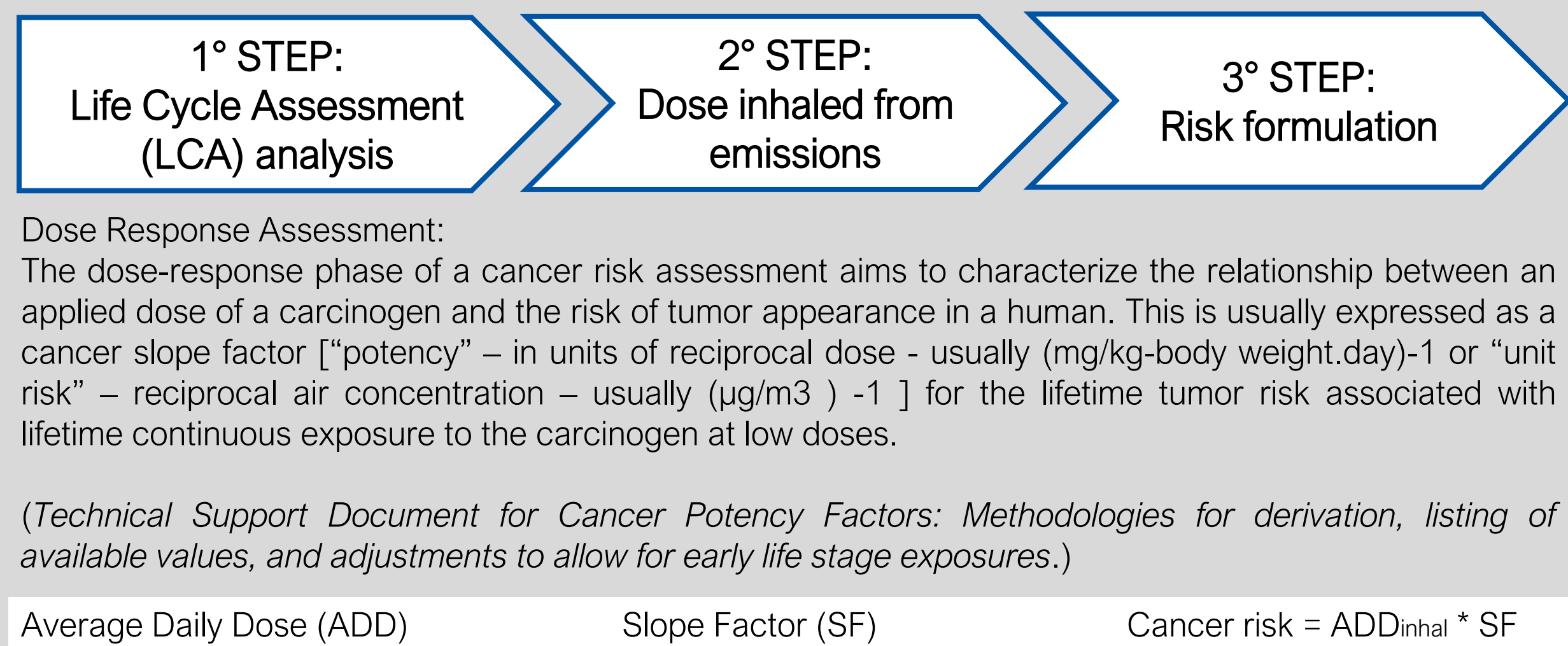
We considered the typical production of WEEE in a municipality of around 150.0000 inhabitants, where a Life Cycle Assessment (LCA) was carried out.

Methods

Outdoor (1km² around a WEEE treatment plant) and indoor (factory volume of 3200m³) direct emissions generated from the above-mentioned procedures were calculated in the LCA analysis, in order to perform a health risk assessment for the general population around the plant and for occupationally-exposed workers.

The dose of the heavy metals cadmium, nickel, arsenic inhaled by the potentially exposed population was estimated using the values obtained through a toxicological model.

Cancer risk due to inhalation was calculated using the method proposed by the California Office of Environmental Health and Hazard Assessment, where exposure through inhalation is a function of the respiration rate, of the concentration of a substance in the air, of the exposure frequency (days/year) and the exposure duration (years).



Results and Conclusions

For the heavy metals considered, generated from WEEE treatment, preliminary results show negligible cancer risk for the general population.

On the converse, some risks may be present for occupational exposures linked to specific procedures (from cancer risk of 1,42x10⁻³ for men working in shredding procedure and exposed to nickel to cancer risk of 4,68x10⁻⁴ for women working with electronic scrap and exposed to arsenic).

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