TOXICITY RANKING OF EUROPEAN INDUSTRIAL FACILITIES

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ABSTRACT

We present a methodology to improve environmental assessment of European facilities, industries and regions by linking the European Pollutant Release and Transfer Register (EPRTR) and USEtox, a consensus model for characterizing human and ecotoxicological impacts of chemicals. A key advantage of our methodology is that it can be used to measure progress towards the UN's Sustainable Development Goals and towards the environmental objectives in the EU Taxonomy regulation on the company facility level and regionally.

Keywords: sustainability, toxicity, USEtox, SDGs.

INTRODUCTION

The key novelty of our research is that we constitute methods to broaden the scope of environmental assessment to non-listed companies in the European Union (EU). Investors, consumers, regulators, banks and other financial intermediaries increasingly need ESG information to make decisions. We present results on the company facility level, and further statistics on various pollutants and major industries across EU regions.

MATERIALS & METHODS

Emissions (E) of substances (i) in the EPRTR are multiplied by their USEtox 2.12 midpoint human- & ecotoxicity characterisation factors (CFs) and aggregated across all substances and release media (j), Eq (1), [1], [2].

$$Impactpotential = \sum_{ijk} E_{ijk} \times CF_{ijk} \qquad (1)$$

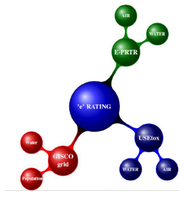


Figure 2: Structure of the environmental assessment

RESULTS 2

There are clusters of toxicity in the most industrialized regions of North-England, North-Italy, the German Ruhr-area, South-Poland, in the Benelux states, and in coastal areas of Spain, Portugal and Nordic countries.

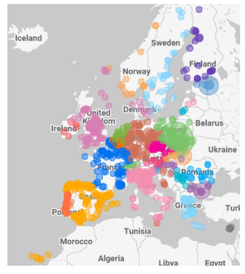


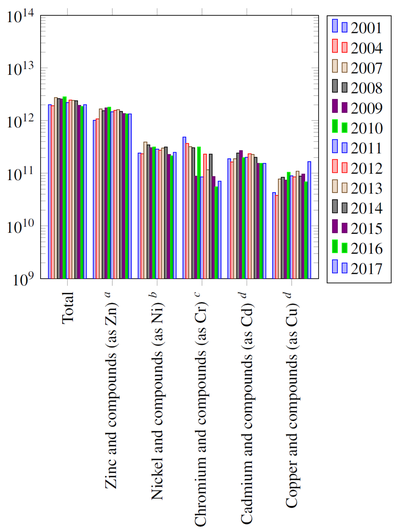
Figure 3: Human toxicity of substances from largest European sources to air, water in 2017.

RESULTS 1

Companies in the electricity production sector are estimated to have the largest human toxicity (52% of total) in the EU and facilities in the sewerage sector the largest ecotoxicity potential (41%). Human toxicity almost halved from 2001 to 2017, although the trend reversed in 2016. Ecotoxicity increased by 20% in the same period.

No	Facility	NACE	Country
1	PGE Bełchat.	Electr. prod.	PL
2	RWE AG	Electr. prod.	DE
3	Enefit	Electr. prod.	EE
4	U.S.Steel	Manuf. iron	SK
5	TAMEH	Air cond. sply	PL

Table 1: Facilities with the largest human toxicity impact in th EU



Notes: [a] As Zn(II). [b] As Ni(II). [c] As Cr(VI). [d] As Cd(II). [e] As Cu(II).

Figure 1: Trend of contribution from substances with the largest contribution to ecotoxicity (CTUe)

CONCLUSION

Our study aims at broadening the coverage of company and facility level environmental impact measurement from earlier methodologies assessing CO2 and climate change risk to chemical footprint.

- Human toxicity impacts: mostly by Hg compounds in the EU, accounting for 71% of total in 2017.
- The facility with the largest contribution to human toxicity is PGE Górn. Bełchatów, a coal-fired station in PL.
- The pollutant with the largest contribution to ecotoxicity: Zn in 2017 (55% of the total) .
- Largest human toxicity footprint was estimated for Production of electricity (52%) .
- Sewerage (41%) is the industry with the largest estimated ecotoxicity footprint.
- Results are relevant for the EU taxonomy (Obj. 5: pollution prevention)

REFERENCES

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[2] Szilárd Erhart and Kornél Erhart. Application of north european characterisation factors, population density and distance-to-coast grid data for refreshing the swedish human toxicity and ecotoxicity footprint analysis. *Environmental Impact Assessment Review*, 92:106686, 2022.

FUTURE RESEARCH

Broadening the scope of the chemical footprint analysis in terms of geographic coverage, pollutant list or indicators (e.g. waste) could be interesting research objectives.
The EPRTR data used in our research covers pollutants which enter the environment from point sources, for example from smokestacks or from discharge pipes of EU facilities. Nonpoint source pollution is more difficult to monitor and neither covered by the EPRTR database nor by our study. The additive toxicity calculation formula in our analysis does not take into account the large number of possible interactions. Especially, the investigation of toxicity consequences from zinc's and mercury's interactions with other pollutants could be a potential research directions.

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