

ASSESSING THE ENVIRONMENTAL AND HEALTH RISKS OF INCINERATORS

ERICA: A NEW INDEX TO COMPARE AND EVALUATE THE OVERALL IMPACT

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INTRODUCTION

- At present global indices are not able to characterize in a single value the potential danger to humans and the environment from chemical compounds and their derivatives as a result of anthropogenic activities (e.g. TCDD/Fs, PCBs, PAHs, etc.), and naturally occurring compounds that augment because of industrial or civil activities (e.g. O₃, NO_x, CO, etc.).
- ERICA (*Environmental Risk Index for a Complete Assessment*) merges in a single number the environmental assessment, the human health risk assessment and the uncertainty due to missing or unreliable data. For this purpose, ERICA adopted a dedicated scoring system, using parameters for relevant characteristics.
- ERICA's innovative feature is to consider the risk in a broader way: ecotoxicology, toxicology, persistency and bioaccumulation are the main indicators of the index we used. We defined a minimum of 19 chemical compounds to establish the scenario to build ERICA.
- ERICA index should be considered as a diagnostic and prognostic method for environmental contaminants in critical and potentially dangerous sites, such as incinerators, landfills and industrial areas, as well as in broader geographical areas.
- ERICA can be used by regulators to make the correct decisions for a better environmental policy.

MATERIALS & METHODS

- The database of ERICA uses 186 chemicals (based on the results of real analytical and quantitative analysis carried out in our laboratory), their relative toxicity and physico-chemical properties from experimental referenced data or predictive reliable methods.
- New validated and predictive methodologies (e.g. EPI Suite, CAESAR models, etc.)¹⁻² were used in the event of missing experimental physico-chemicals or toxicological values.
- ERICA is based of 3 main parts (see Fig. 1): human toxicological index (HQI), human carcinogenic index (HCR) and ecotoxicological index (EQI). All these indicators are calculated following updated technical guidance on risk assessment³⁻⁶. The overall risk for each substance (SRI) is a balanced addition of these indices. The environmental risk (ERI), risk weighted on specific chemical properties, is then calculated multiplying SRI for the compound specific environmental fate and transport index (EFI). Risk limit is used for the compounds without data on environmental concentrations (or without law limit).
- 19 priority compounds (Minimum Scenario, MS) were defined on the basis of and their relevance and the relative knowledge of their toxicological profiling, their environmental distribution and anthropic emissions.
- MS method is adopted to compare different sites along space and time dimension. It is possible to enlarge the MS adding other relevant pollutants.

CASE STUDIES

- ERICA was tested on 3 Italian sites surrounding incinerators in order to evaluate its usefulness (Case 1, 2 and 3): see Fig. 2.
- For these case studies a large inventory of environmental concentrations derived from dedicated chemical analysis for the compartments (soil, water, air) has been already produced in our analytical department.
- A comparison was made between the pollutants found in the case studies and the levels acceptable under Italian law: see Fig. 2.⁷ The legal limit case falls in the moderate status and depicts the dishomogeneous distribution of legal limit compared the toxicological limit.
- The three case studies tested with ERICA gave comparable environmental and health status within the detailed risk assessment analysis performed by our laboratory.

Tab. 1 : ERICA classification of environmental and health status

Environmental and health status		ERICA
Environmental Quality		ERICA
VERY GOOD		< 25
GOOD	64 Case 3	25-49
MODERATE	70 Case 2	50-99
UNHEALTHY FOR SENSITIVE GROUPS	72 Case 1	100-149
UNHEALTHY	84 Legal limit	150-199
VERY UNHEALTHY		200-299
DANGEROUS		300-399
EXTREMELY DANGEROUS		> 400

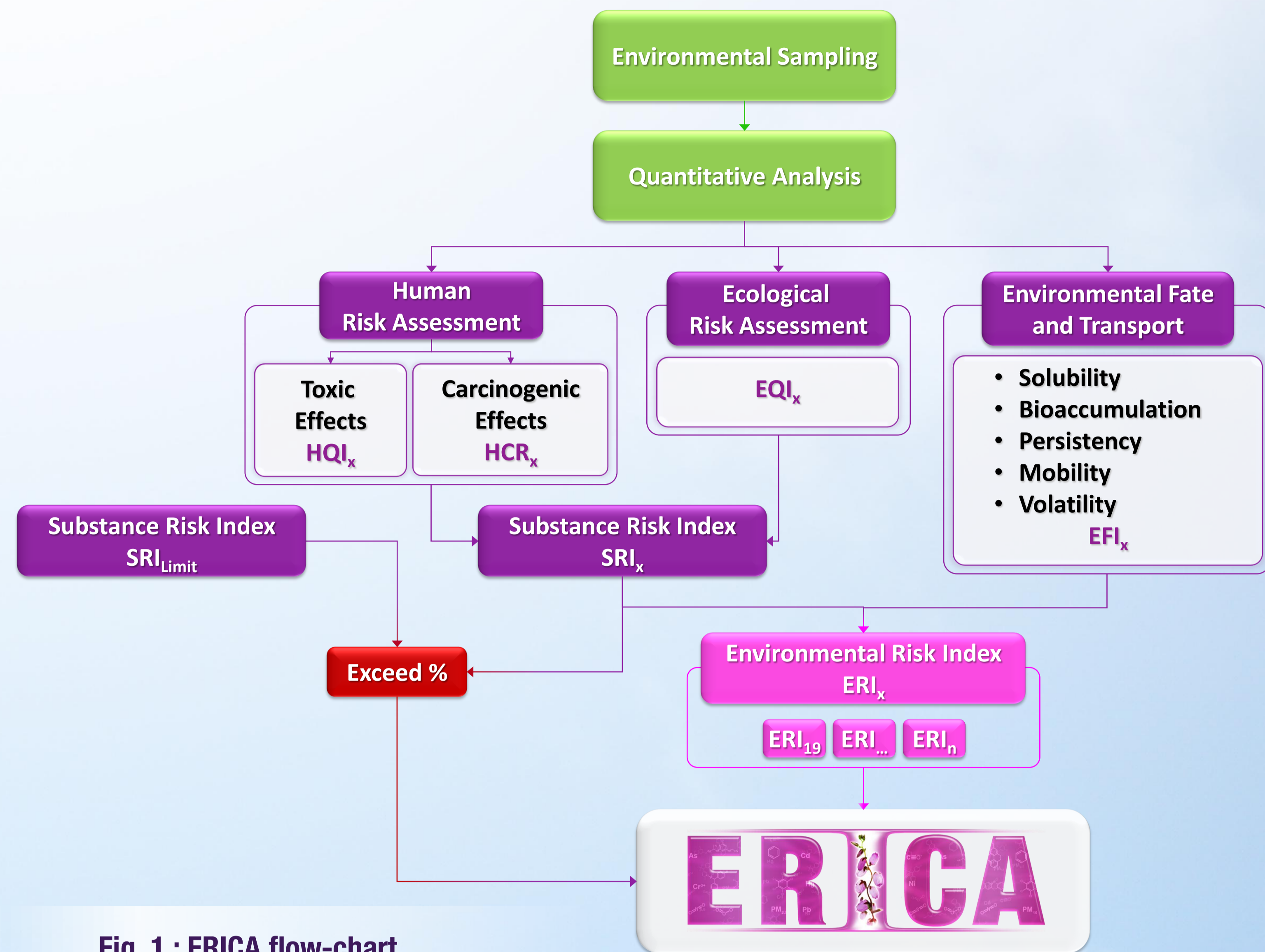


Fig. 1 : ERICA flow-chart



Fig. 2 : Risk distribution of 19 pollutants used in the 3 case studies and legal limit case. Red line shows the risk threshold for environmental status

DISCUSSION & CONCLUSIONS

ERICA Advantages

- Simple approach giving in a single value a detailed analysis of the global risk for the area under observation.
- Comparison of different plants with possible integration of their emissions in a certain territory.
- Evaluation of the evolution of environmental health status with time.
- A concise, transparent, clear metre to be used by assessors.
- Useful to get a comprehensive picture of the general situation of a critical area.
- Functional for an in depth risk analysis of potentially dangerous compounds also along both time and space dimensions.

REFERENCES

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for FURTHER INFORMATION or TO TRY ERICA WITH YOUR DATA please contact:

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