SCORE LCA

# *Call for Tenders n° 2019-01*

**Considering particles in impact assessment methods**

Deadline for email and paper responses:

**Monday 21 October 2019**

Context :

The LCA methods for the characterization of environmental impacts have trouble dealing with health and environmental impacts caused by particles.

While the Particulate Matter category has a score of I (robust) in the ILCD ranking, the recommended method named UNEP 2016, does not cover all issues of these impacts nor all types of particle.

This study will identify the way the health and environmental impacts caused by particles (inside and outside LCA) are considered.

Then, some recommendations will be proposed to better integrate the effects of particles in LCA studies in order to evaluate the impacts in a more robust and accurate way.

Some practical short-term recommendations could be provide to help practitioners on the one hand and the method developers on the other hand, to enhance the existing methods.

## Objective

- Provide a state of the art of the consideration of particulate matter inside and outside LCA
- Give some recommendations for both the practitioners and the method developers to :
  1. Improve the consideration of the issues of the impacts of particles in LCA using existing methods
  2. Improve existing tools.

## Study content

### I. Literature review

#### A. In general

This first part aims at gathering all the scientific information needed for the quantification of particles impacts on health AND the environment. A literature review will be carried out and the sources will be detailed. The most important and relevant source will be identified.

This quantification will be based on a full range of relevant parameters as: the size of the particles, the site of emission (e.g. indoor or outdoor), the nature or composition of particles (e.g. carbon black, nanoparticles), the site or way of receipt of the particles, etc.

The existing studies on the principal modes of action and effects will be detailed in order to allow to evaluate what should be taken into account in LCA or should be excluded, in particular in the different impact methodologies (Human Health, Climate Change, etc.).

Some specific methods as Quantitative Health Risk Assessment and HIA or other sectoral ones, will be investigated to determine what could be used to address health impacts.

#### B. Considering particles in LCA

The goal will be to realize an exhaustive state of the art of the LCA literature to highlight the way the particles are actually taken into account in existing and developing LCA indicators. Especially, the following aspects will be analysed:

- What are the impact categories that really consider particles (the “Particulate Matter” categories but also other categories)

- What type of particles are considered (size, composition, source of emission, primary or secondary pollutant, etc.),

- Which effects are really integrated (health effects as respiratory or carcinogenic one, environmental effects as the limitation of the sun glare by the snow, creation of aerosol or smog…)

- What is the spatial distribution?

Other relevant aspects could be analysed.

In comparison with the A part, this analysis will highlight the different elements that are not considered (or badly considered) in LCA. The reasons will be detailed : lack of data on nature of particles, lack of data on measuring step, complexity of impact pathways, decide not to take the time to integrate them, not significant effect, etc. They will be identified through existing publications and the respondent will share his opinion on them.

## II. Recommendations

Recommendations will be provided for a more precise and more robust integration of Particulate Matter in LCA :

- Help the Practitioner during the model phase: How to better integer the impact of particulate matter in LCA using existing methods? What are the good practices? (collection of primary information, taking into account secondary information, complementary modelling, implementation within the LCA software, parameterization of values, sensitivity analyzes, adaptation of characterization factors in LCA software…)

- Help the method developer, for different indicators: how to improve existing tools (which degree of detail for the flows to consider the different parameters of particulate matter, which characterization factor for these flows…)

This work will complement the one already realized in 2016 during the Pellston Workhsop of UNEP/SETAC (see in annex).

It will also complete the work of DG JRC, 2018, that resulted in the publication of the characterization factors EF v3.0 for the transition phase of PEF.

**Annex 1**

This appendix first reminds of the conclusions of the Pellston Workshop to which Peter Fantke, John Evans, Natasha Hodas, Joshua Apte, Matti Jantunen, Olivier Jolliet et Thomas E. McKone, contributed, including some limitations, and their recommendations, in the order of priorities.
It then presents the application made by DG JRC for the work of the PEF transition phase thus generating EF 3.0 factors. This application again provides limitations.
The public detailed documentations give more detailed information that will be useful to conduct this project.

**Annex 1.1**

Extract from "Global Guidance for life cycle impact assessment indicators Volume 1", UNEP, 2016.

**Summary results**

"Fine particulate matter health impacts: Recommended characterization factors (CFs) for primary PM2.5 and interim recommended CFs secondary PM2.5 are established, which distinguish between archetypes for rural and urban areas and for indoor and outdoor emission and exposure settings. Outdoor CFs further distinguish between different emission stack heights."

**"7.4. Health impacts of fine particulate matter**

"To date, health impacts of particulate matter (PM) and specifically the respirable fraction of PM less than 2.5 microns in mass median diameter, termed PM 2.5, have not been consistently incorporated in LCIA modeling. One of the major goals of the PM task force was to rectify this situation using the latest science and fate and effects modeling, and to ensure the results of the LCIA modeling was consistent with the epidemiologic literature for relevant indoor and outdoor environments. The primary reference data source driving this effort is the Global Burden of Disease last updated and published in 2015.

The task force effort resulted in a number of innovations that brought an LCIA approach to address health impacts from exposure to PM2.5. In a kick-off experts workshop several issues were identified and evaluated by the task force members and then organized by priority, relevance, and feasibility. Among the task force innovations are specific recommendations to address a variable range of source-to-exposure archetypes and the ability to treat secondary PM2.5 (formed in the atmosphere from gaseous precursors), as well as primary PM2.5.
Although the most fundamental form of the PM2.5 model conforms exactly to the decades old standard of IMPACT = EMISSION X CF, the elaboration of this model within the archetypes and within an LCA framework required numerous innovations in both the source-to-exposure component (population intake per kg emitted) and in the exposure-to-impact endpoint assessment, with impact expressed in cumulative disability-adjusted life years (DALYs) per kg intake.

In developing a framework for addressing PM2.5 in LCIA, the task force made a number of overarching and specific recommendations. Many of these recommendations deal with actions that increase both the reliability of and confidence in modeling exposure and applying exposure-response functions (ERFs) in the context of available data. The task force found that modeling results closely matched monitoring data in several situations, thus lending

confidence to the actions proposed. The task force's main recommendations address both the process for linking emissions to exposure and the process for linking exposure to disease and mortality.

**Summarized and prioritized below are overarching recommendations.**

**Strong Recommendations:**

- Use the intake fraction to capture source-receptor relationships for both primary and secondary PM2.5 for both outdoor and indoor emissions.
- Organize impacts and exposures organized according to whether emissions originate outdoors or indoors, in urban or rural regions, and as ground level versus stack emissions. Where possible use city-specific intake fractions to capture large intraurban variability.
- Make use of available and well-vetted exposure response models for assessing both total mortality and disease-specific DALYs associated with PM2.5 exposures both indoors and outdoors.
- Include background exposure to PM2.5, as well as background disease incidence (and/or mortality) in the calculation of impacts for any selected population to ensure proper application of these models to LCIA.

**Recommendations:**

- Make use of interim recommended generic factors for very high, high, and low stack emissions based on the use of ground level emissions and correction factors from current literature until better models become available.
- Make use of current literature values for secondary PM 2.5 formation indoors.
- Include qualitative and (when possible) quantitative characterization of variability and uncertainty.

**Interim Recommendations:**

- Make use of global exposure distributions to characterize the impacts of emissions when emission locations are not specified and in the absence of more detailed data or information.
- Use high-background indoor PM2.5 values associated with solid fuel cooking in regions where these data are available.
- Focus on primary PM2.5impacts in urban areas when detailed models of secondary PM2.5 formation are not available."

"Spatial resolution is an issue common to three out of the four topical areas, i.e., particulate matter emissions, water use impacts, and land use impacts. All three groups agreed on providing characterization factors on the native scale (like watersheds or ecoregions), as well as on more aggregated levels such as countries, continents, and the globe (water use impacts and land use impacts), or archetypes such as indoor or outdoor and rural or urban (PM)."

**Annex 1.2**

Extracts from "*JRC Technical Reports: Supporting information to the characterisation factors of recommended EF Life Cycle Impact Assessment methods - Version 2 from ILCD to EF 3.0*", 2018.

**What's new respect to ILCD:**

The method adopted in ILCD characterized the impacts in kg of $PM_{2.5}$ equivalents, and was based on three different references (Rosenbaum et al. 2008, Greco et al. 2007, Rabl and Spadaro 2004), combined as proposed in Humbert (2009). The new method is characterising the emissions as disease incidence due to the emission of PM, as defined by Fantke et al. (2016).

**Deviations or adaptations from the original method:**

Specific CFs for $PM_{10}$ have been derived, since were not available in the original method, while for other particulates ($PM_{0.2}$ and $PM_{0.2\text{-}2.5}$), the factor associated to $PM_{2.5}$ has been adopted. Further explanations are reported below.

| *Impact category* | *Model* | *Indicator* |
|---|---|---|
| Particulate matters, midpoint | Fantke et al. (2016) in UNEP (2016) | Disease incidences |

The recommended model is the one developed by the UNEP-SETAC Task Force (TF) on particulate matter (PM) in 2016 (Fantke et al. 2016). It aims at assessing damage to human health from outdoor and indoor emissions of primary and secondary PM2.5 in urban and rural areas.

According to Fantke et al (2016), the midpoint indicator is the change in mortality due to PM emissions, expressed in deaths/kgPM2.5 emitted. A different name is used in the present report and in the EF2017 method, namely disease incidences/kgPM2.5emitted. The values of CFs are the same as in the original source.

The characterization factors provided by the model for the average ERF were collected as they are published by model developers and then mapped to the ILCD elementary flow list. Name correspondence and the similarity in the description of the archetype represented by the flow were the main criteria used.

For the flows of unspecified emissions, a precautionary approach was applied, by assigning the highest CF among those available for that kind of particle.

The model assessed does not provide a CF for the elementary flow "PM10", because the PM2.5 fraction is considered the main responsible of impacts on human health. However, some life cycle inventories include only PM10 and not PM2.5. Hence, an assumption of the impact coming from emissions of PM10 (i.e. a related CF) is made, to avoid disregarding some of the emissions included in the inventory. In line with what was done for the previous recommendation, the CF for PM10 is calculated by multiplying the CF for PM2.5 by 23% (i.e. by the fraction of PM2.5over the total amount of PM10).

The elementary flows "Particles (PM0.2)" and "Particles (PM0.2-2.5)" were not included in the original model. However, they could be part of the inventories currently used. Therefore, to avoid disregarding the emission of very small particles, the CF for PM2.5 is assigned as a proxy to these flows (and related sub-compartments).

## Workplan

Three main steps are expected :

1) Detailed presentation of the problem, working mode of the team. This work will consist mainly in deepening the elements presented in the commercial offer and detailing some particular elements. It will be detailed during the inception meeting. Following this, an inception report will be produced and sent to the monitoring committee, which will make remarks and finally validate it.

2) The intermediate meeting will present all the results of the state of the art inside and outside LCA. These elements will be discussed during the meeting. An interim report, gathering all the work done at this stage will be sent at least two weeks before the intermediate meeting to the monitoring committee, which will produce comments (during and after the meeting).

3) The objective of this third phase of the project is to produce a final report answering all the objectives of the project, and this before the final meeting. Practical and concrete recommendations will be proposed in the draft final report and discussed at the final meeting. This draft final report will be send three weeks before the final meeting to the monitoring committee that could produce comments before and during the final meeting.

This meeting will present the work done since the intermediate meeting, recommendations (taking into account comments received) and discussions. Additional comments may be produced after the meeting if necessary. These comments should be incorporated into the final version of the final report..

## Meetings

Taking part of three meeting in Paris (eventually in Lyon):

- Launch (including a working plan description and the inception report, two weeks after the beginning of the study),
- Mid-term (including the presentation of the literature review results and the first key items)
- Final (including the final temporary report and the interim French scientific overview).

For each meeting, the team will be in charge of the presentation materials (PDF or PPT in French or English).

The meeting will be held **in French language** in preference (English accepted).

Finally, the team will hold a **feedback meeting** in French (English accepted) during about an hour by web conference (system supported by SCORE LCA if needed). The meeting, carried out after the final meeting, will aim to present the detailed results of the study to active and partners members and to any person SCORE LCA wish to invite.

## Deliverables required

- 1 inception report in English or French,
- 1 mid-term report in English or French,
- 1 final report in English or French,
- 1 set of slides in English presenting summarized overview of the main findings of the study,
- 1 scientific overview in around 5000 words (including: summary + detailed scientific content of the study) in French,
- 1 scientific overview in around 5000 words (including: summary + detailed scientific content of the study) in English,
- Conducting a webinar restitution of the results for members, in French (English possible), at the end of the project (duration : 1 hour).

## Study duration

**About 6-9 months**. The launch meeting will take place in Paris in November.

## Budgetary framework

**About 30 000 Euros duty-free**. The offer could add optional propositions to be discussed.

## Notes

If the content of the realized work makes it possible, the selected team could be highly encouraged by SCORE LCA to participate in the enhancement of the results (preparation of publications, participation in workshops…): including a detailed option covering this aspect in the offer and a dedicated budget in the financial proposal is strongly recommended.

Moreover, the team could propose to SCORELCA any promoting action that seems appropriate.

The proposed team in the response must be the one that realizes the study. The amendment of the applicant team after filing the reply may question the choice of members of SCORELCA.
Any change in the proposed team during the study should be notified to SCORELCA, the reorganization should be detailed and subject to the acceptance of SCORELCA.

## Submission

The projects must be presented with a document based on the English form available on the SCORELCA website: www.scorelca.org

**Careful! The responses are limited to 30 pages !**

The deadline for the submissions is **Monday 21 October 2019.** (email date and postmarked by the deadline date)

Each response really must be sent *by paper mail* to the following address:

**SCORELCA**
**Bât. CEI 1**
**66 Boulevard Niels Bohr**
**CS 52132**
**69603 VILLEURBANNE cedex**
**FRANCE**

AND *by email* to:

contact@scorelca.org

## Responses evaluation

Beyond compliance of the answers to the above instructions, the main evaluation criteria will be the quality and the argument of the response, the skills of the applicant team and particularly his knowledge on the different type of particles and the health and environmental impacts. A knowledge and experience of performing LCA in various sectors (experiments, publications, etc.) will be necessary. In addition, the evaluation will pay attention to the complementarity of the proposed skills. If a partnership is proposed, **any details on the organization and the link between the different entities (to demonstrate the effectiveness of the partnership during the project) will be appreciated**.

Finally, the educational aspect of the project will be a great differentiating element.