United Nations ECE/EB.AIR/GE.1/2020/13–ECE/EB.AIR/WG.1/2020/6

Economic and Social Council

Distr.: General
3 July 2020

English only

Economic Commission for Europe

Executive Body for the Convention on Long-range Transboundary Air Pollution

Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

Working Group on Effects

Sixth joint session
Geneva, 14−18 September 2020
Item 3 of the provisional agenda
Progress in activities in 2020 and further development of effects-oriented activities

Effects of air pollution on materials

Progress report by the Programme Coordinating Centre of the International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments

Summary

The present report by the Programme Coordinating Centre of the International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments (ICP Materials) under the Working Group on Effects presents the results of the activities undertaken by ICP Materials between May 2019 and May 2020. The activities and the report thereon are presented in accordance with the 2020−2021 workplan for the implementation of the Convention (ECE/EB.AIR/144/Add.2, items 1.1.1.5.-6.) and with the revised mandate for the ICP Materials (Executive Body decision 2019/19).[1]

The Programme Coordinating Centre report presents the results of the thirty-sixth ICP Materials Task Force meeting (online, 6−8 May 2020). It describes trends for environment, corrosion and soiling during the period 1987–2018, including results from the recently completed trend exposure 2017−2018, and summarizes the status of the call for data and future plans on inventory and condition of stock of materials at risk at United Nations Educational, Scientific and Cultural Organization World Cultural Heritage Sites.

[1] Available at www.unece.org/env/lrtap/executivebody/eb_decision.html.

I. Introduction and overview of deliverables

1. The present report by the Programme Coordinating Centre for the International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments (ICP Materials) describes the activities carried out by ICP Materials between May 2019 and May 2020. It highlights the results of activities undertaken since its previous report (ECE/EB.AIR/GE.1/2019/13−ECE/EB.AIR/WG.1/2019/6), submitted to the fifth joint session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe and the Working Group on Effects (Geneva, 9−13 September 2019). The results are presented here in accordance with the 2020−2021 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/144/Add.2).

2. ICP Materials is co-chaired by Mr. Johan Tidblad (Sweden) and Mr. Pasquale Spezzano (Italy), with Mr. Tidblad also acting as the head of the ICP Materials Programme Coordinating Centre. Participating in the work of ICP Materials are some 30 experts from the following 18 countries: Austria, Croatia, Czechia, Estonia, Finland, France, Germany, Greece, Italy, Norway, Poland, Russian Federation, Slovakia, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland and United States of America.

3. The thirty-sixth meeting of the ICP Materials Task Force (online, 6−8 May 2020) was attended by 23 participants from 12 countries, including the Chair of the Working Group on Effects and a representative of the Convention secretariat.

4. During 2019, the following reports were delivered: “Results of corrosion and soiling from the 2017-2018 exposure programme for trend analysis”;[2] and “Call for data ‘Inventory and condition of stock of materials at UNESCO world cultural heritage sites’. Part III – Economic Evaluation”.[3]

5. In 2020, the following ICP Materials reports are expected: “Environmental data report”; “Report of trends in corrosion, soiling and pollution 1987–2019”; and “Relative importance of individual pollutants and the effect of their reduction on the damage cost for selected UNESCO sites”.

II. Workplan items common to all International Cooperative Programmes

A. Guidelines for reporting on the monitoring and modelling of air pollution effects

6. The guidelines for reporting on the monitoring and modelling of air pollution effects (ECE/EB.AIR/2008/11−ECE/EB.AIR/WG.1/2008/16/Rev.1)[4] specify that, for effects of particulate matter on materials, the degree of soiling should be reported, and for multiple pollutant effects on materials, the corrosion of indicator materials (carbon steel, zinc and limestone) should be reported. This is part of the ongoing activities of ICP Materials (for exposure of materials for trend analysis, see section III.A below).

[2] International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments (ICP Materials), Report No. 85 (Kista, Sweden, Research Institutes of Sweden, 2019). Available at www.corr-institute.se/icp-materials/web/page.aspx?refid=18.

[3] ICP Materials, Report No. 86 (Rome, National Agency for New Technologies, Energy and Sustainable Economic Development, 2019). Available at www.corr-institute.se/icp-materials/web/page.aspx?refid=18.

[4] Adopted by the Executive Body for the Convention on Long-range Transboundary Air Pollution at its twenty-sixth session (Geneva, 15–18 December 2008) (ECE/EB.AIR/96/Add.1, decision 2008/1, para. 1).

B. Efforts to enhance the involvement of countries of Eastern Europe, the Caucasus and Central Asia

7. Discussions are being held on a continuous basis but countries of Eastern Europe, the Caucasus and Central Asia do not currently actively participate in ICP Materials work.

C. Cooperation with programmes and activities outside the region

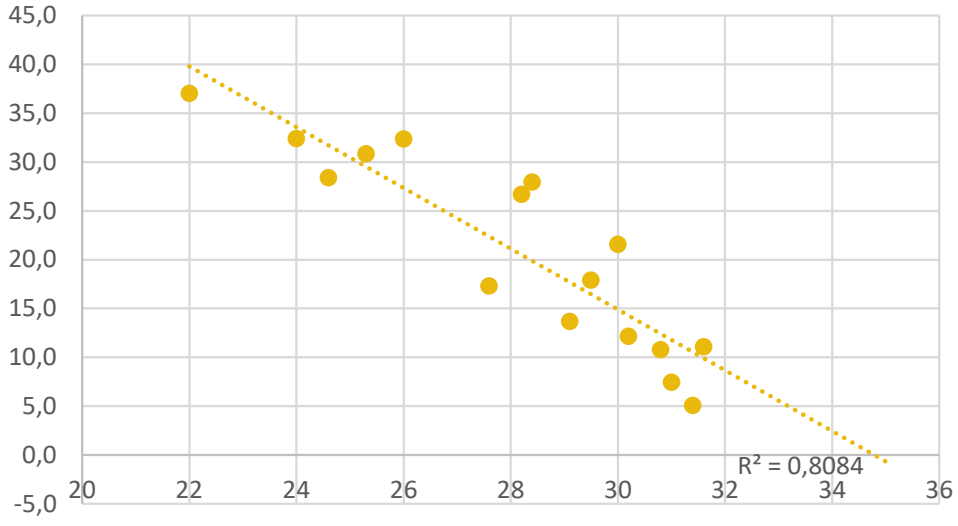
8. ICP Materials and its experts collaborate regarding international standardization work in the field of atmospheric corrosion, in particular in the context of International Organization for Standardization Technical Committee 156 - Corrosion of metals and alloys and European Committee for Standardization Technical Committee 346 - Conservation of cultural heritage. A current workplan item related to the work of ICP Materials is the preparation of a new International Organization for Standardization technical report on procedures for mapping corrosion.

III. Workplan items specific to the International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments

A. Corrosion and soiling of selected materials under different environmental conditions

9. Exposures for trend analysis are performed every third year in the network of ICP Materials test sites. The completed exposure (2017−2018) included corrosion samples of carbon steel, stainless steel, weathering steel, zinc, copper, limestone and soiling samples of modern glass, limestone, marble and coil-coated materials. The data will be included in the "Report on corrosion and soiling data from the 2017−2018 exposure for trend analysis". The addition of new soiling samples is in line with the long-term strategy to increase focus on soiling materials and effects of particulate matter. First results show a good correlation between environmental parameters (particulate matter - PM_{10}) and gloss of coil-coated materials (see figure below), which is promising for future development of dose-response functions for soiling of non-transparent materials.

Correlation of PM_{10} vs Gloss of white coil-coated samples exposed for one year in the ICP Materials network of test sites (Source: Tiina Vuorio, HAMK Tech, Hämeenlinna, Finland)



B. United Nations Educational, Scientific and Cultural Organization World Cultural Heritage Sites

10. In line with the 2020–2021 workplan for the implementation of the Convention (ECE/EB.AIR/144/Add.2, workplan item 1.1.1.6), ICP Materials continues to gather and process information on policy-relevant and user-friendly indicators on the effects of air pollution on materials. These activities are currently conducted within the scope of the call for data on inventory and condition of stock of materials at risk at United Nations Educational, Scientific and Cultural Organization (UNESCO) world cultural heritage sites launched in October 2015 and involving six Parties to the Convention: Croatia, Germany, Italy, Norway, Sweden and Switzerland.

11. The main risk factors (pollutants) for the different risks (corrosion/soiling) were assessed by using dose-response functions established by ICP Materials. Results were compiled in a report entitled "Call for data 'Inventory and condition of stock of materials at UNESCO world cultural heritage sites'. Part II – Risk assessment.[5] The evaluation of the expected cost of the damage due to air pollution was presented in a report entitled "Call for data "Inventory and condition of stock of materials at UNESCO world cultural heritage sites". Part III – Economic evaluation".[6] Main results are summarized in the table below. According to the methodology used, the cost due to air pollution represents an average of 71 per cent of the total maintenance costs due to the recession of limestone and an average of 66 per cent of the total maintenance costs due to the corrosion of copper. The soiling cost seems more contained, representing on average 35 per cent of the total maintenance cost for the soiling of the limestone and 33 per cent of the total cleaning cost for the soiling of glass. Under current conditions, the costs attributable to air pollution constitute a significant percentage of the total costs that must be addressed for a proper maintenance of the materials of the European cultural heritage.

Additional cost, expressed per unit of surface area of material and year, due to current air pollution for the materials constituting the artefacts

[5] ICP Materials, Report No. 83 (Rome, National Agency for New Technologies, Energy and Sustainable Economic Development, 2019). Available at www.corr-institute.se/icp-materials/web/page.aspx?refid=18.

[6] ICP Materials, Report No. 86.

Material (risk)	*Maintenance cost in a background scenario (€ m^{-2} $year^{-1}$)*	*Additional cost due to current air pollution (€ m^{-2} $year^{-1}$)*	*Percentage of total maintenance cost attributable to air pollution*
Limestone (surface recession)	4.4	3.1 - 20	41 – 82 (average: 71)
Copper (corrosion)	3.5	5.1 - 9.8	59 – 74 (average: 66)
Limestone (soiling)	25	0 - 52.1	0 – 68 (average: 35)
Glass (soiling)	6.8	0 - 11.7	0 – 63 (average: 33)

12. At the thirty-sixth meeting of the ICP Materials Task Force, the relative importance of individual pollutants and the effect of their reduction on the damage cost were discussed. A large part of the meeting session on UNESCO world cultural heritage sites was dedicated to discussion of results from economic evaluation. The results will be presented in ICP Materials Report No. 89 expected in 2020. During the meeting, a discussion was also started on possible ways of upscaling economic results.

IV. Messages for the attention of other bodies

13. Results from the 2017–2018 exposure for trend analysis are promising regarding correlation between PM_{10} and soiling of coil-coated materials. A new update of the mapping manual is planned to include soiling (2021) and will include dose-response functions for transparent (glass) as well as non-transparent materials (painted steel, white plastic and polycarbonate membrane).

14. ICP Materials continues to gather and process information on policy-relevant and user-friendly indicators on the effects of air pollution on materials. This activity is carried out within the scope of the call for data on inventory and condition of stock of materials at risk at UNESCO world cultural heritage sites launched in October 2015 and involves six Parties to the Convention: Croatia, Germany, Italy, Norway, Sweden and Switzerland. Risk factors (pollutants) for different risks to materials constituting the artefacts have been identified (2018), as well as the annual cost of damage attributable to air pollution (2019). New findings on the relative importance of individual pollutants and the effect of their reduction on the damage cost are expected in 2020.