ICP Materials

Progress in activities in 2020 and future work

Sixth Joint Session of the EMEP Steering Body
and the Working Group on Effects
14 - 18 September 2020

Contents

- Progress in work plan items
- Trends in corrosion, soiling and pollution 1987–2019 – importance of individual pollutants
- UNESCO cultural heritage sites – importance of individual pollutants
- Overview of meeting in 2020
- Summary of main messages (as text for minutes)
- Invitation to meeting in 2021

Progress in work plan items, ECE/EB.AIR/144/Add.2: 2020–2021 workplan for the implementation of the Convention

- 1.1.1.5 Impact of corrosion and soiling including trends
  - Environmental data report (2020) – Report 87 published on web page
  - Report of trends in corrosion, soiling and pollution 1987–2019 (2020) – Report 88 published on web page **– selected results in this presentation**
  - Technical Manual 2017–2021 (2021) – New exposure for trend analysis planned to start in October
  - Revision of the Mapping Manual to include soiling (2021) – First draft and decisions on included materials
- 1.1.1.6 Policy-relevant user-friendly indicators (UNESCO sites)
  - Report focused on the relative importance of individual pollutants regarding the cost of damage for selected UNESCO sites (2020) – Report 89 Published on web page **– selected results in this presentation**
  - Report on application of models with increased resolution (1km x 1km) at selected UNESCO sites (2021) – Preliminary selection of suitable sites and model outputs

Monitoring and assessment of the impact on the environment of corrosion and soiling effects on materials and their trends

Report 88

Acidification – SO_2

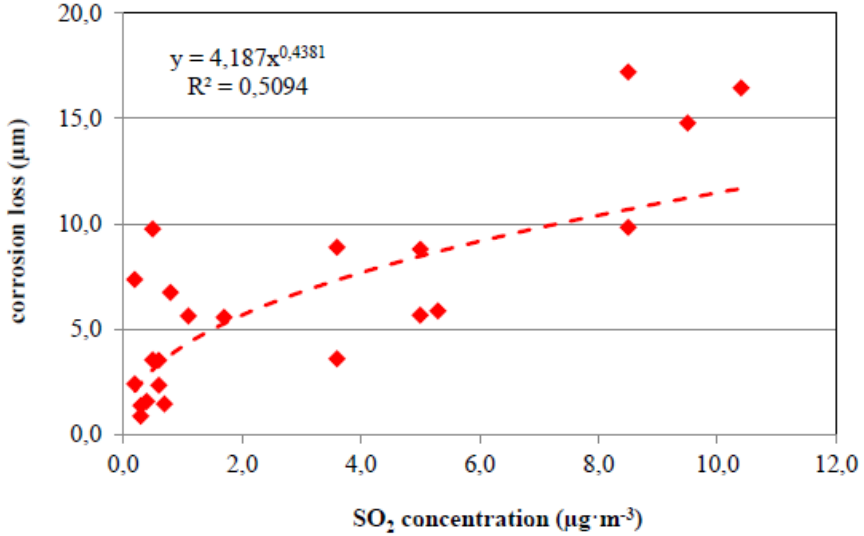


Figure 5 Correlation between carbon steel corrosion loss and individual environmental parameters

For most materials, the effect of SO_2 is still significant despite the low levels.

Many other factors influence the corrosion as well.

The predictive ability of existing dose-response functions has decreased.

Ozone – copper 1(2)

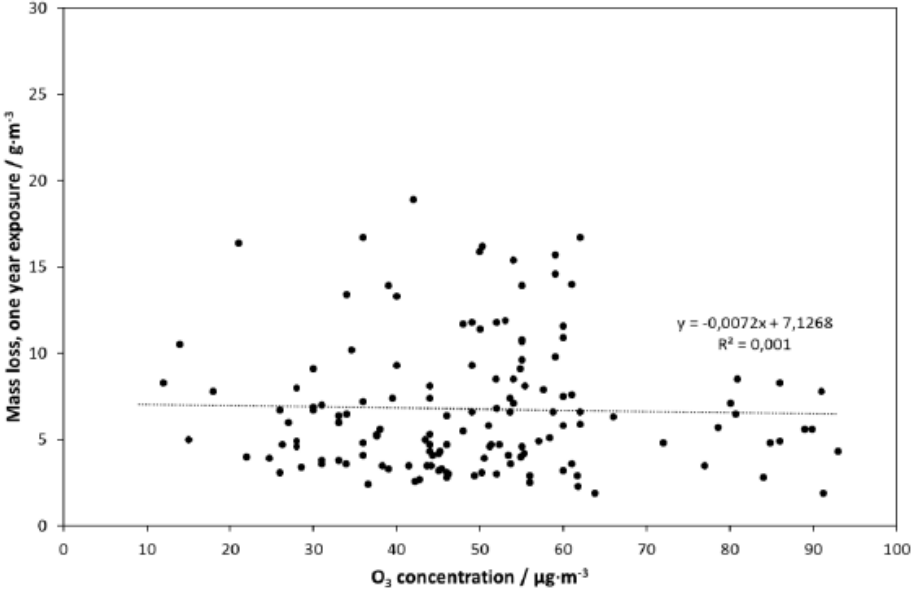


Figure 25 Linear regression between one-year mass loss of copper and O_3 concentration during 1987-2017

Ozone is included in the present dose-response function for copper (combined with SO_2).

There is no direct effect.

Ozone – copper 2(2)

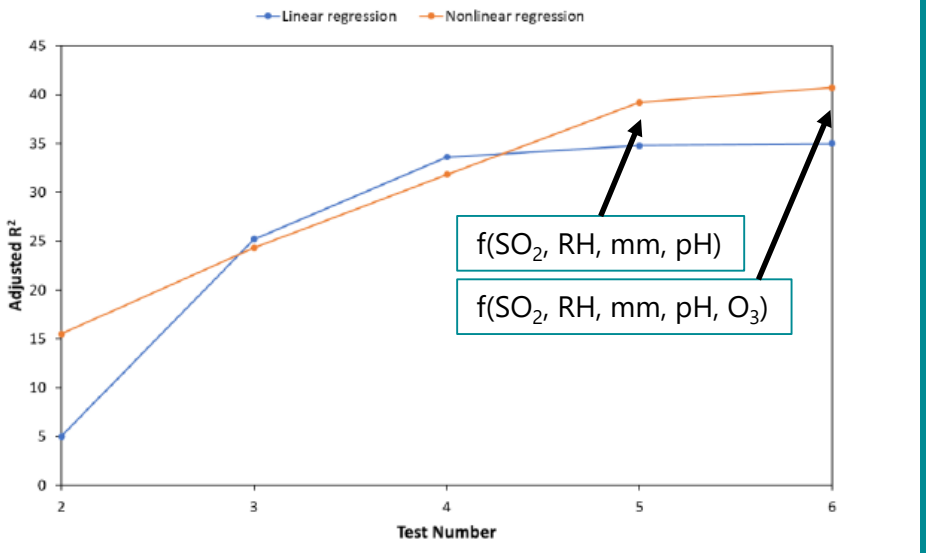


Figure 31 Adjusted R^2 values from statistic analysis. The test number also represents the number of degrees of freedom of the model (number of fitted parameters).

Ozone can possibly have a small contribution, but this is only seen in a complicated non-linear analysis.

PM – soiling of modern glass

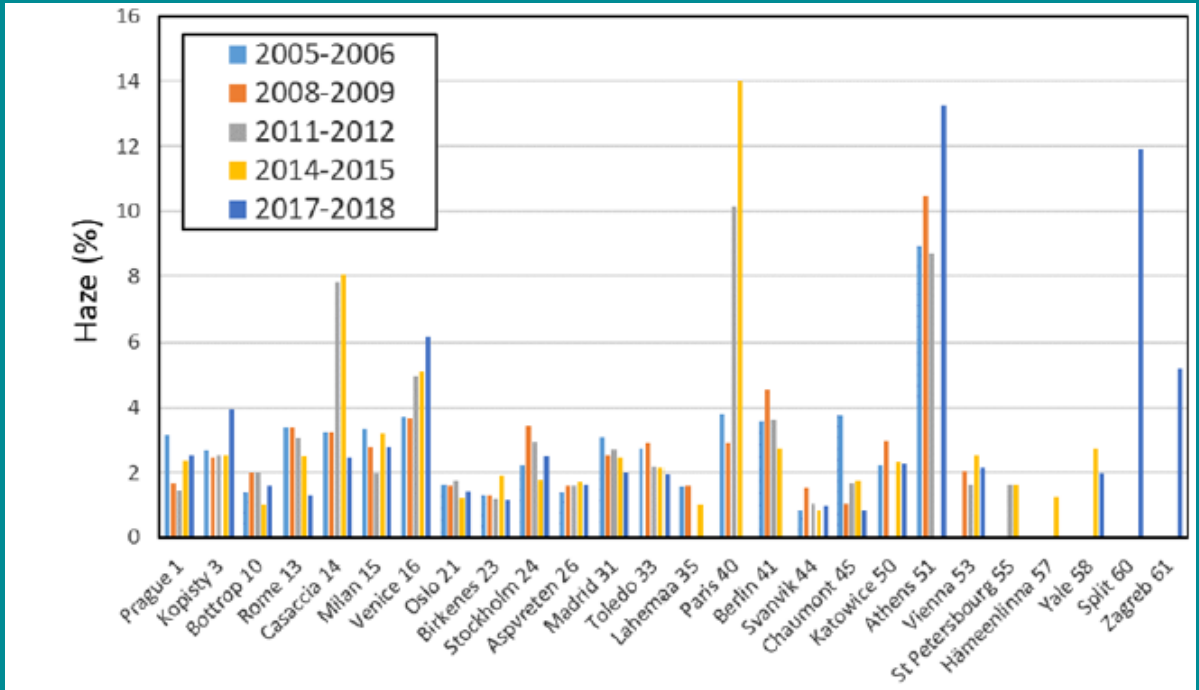


Figure 56 Comparison of haze for different exposure periods

PM is included in dose-response function for Haze.

There is no decreasing trend of haze

PM – soiling of coil coatings

For the new coil coated soiling materials there is a strong correlation between PM10 and gloss.

No trend data so far.

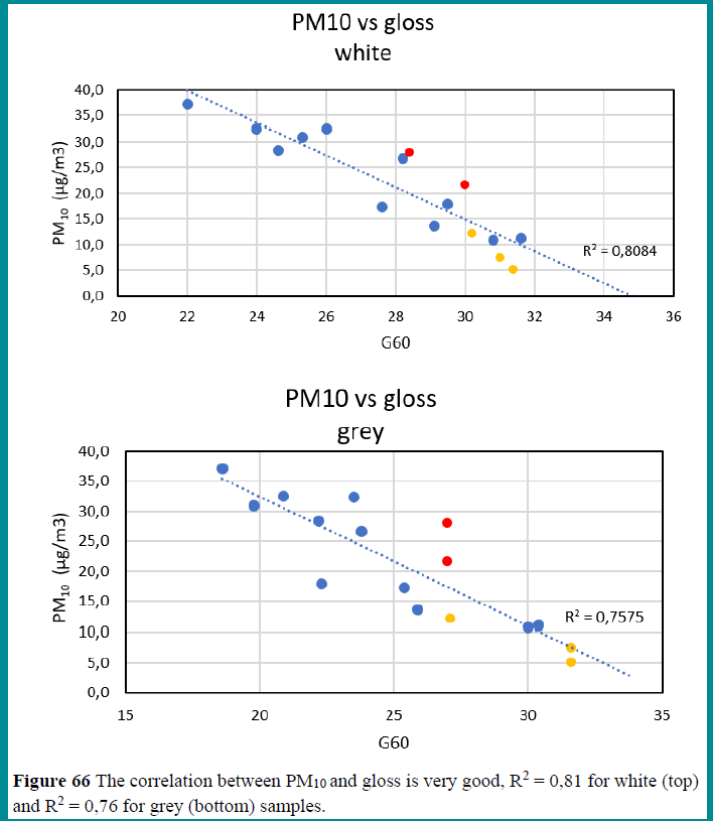


Figure 66 The correlation between PM_{10} and gloss is very good, $R^2 = 0,81$ for white (top) and $R^2 = 0,76$ for grey (bottom) samples.

PM - corrosion

No correlation between PM and corrosion (despite several potential effects)

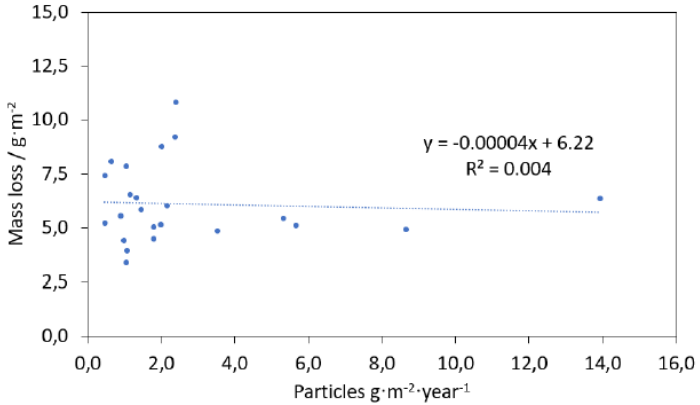


Figure 8 Linear regression between particles and mass loss. The regression line shows no dependence of mass loss on particles

Zinc

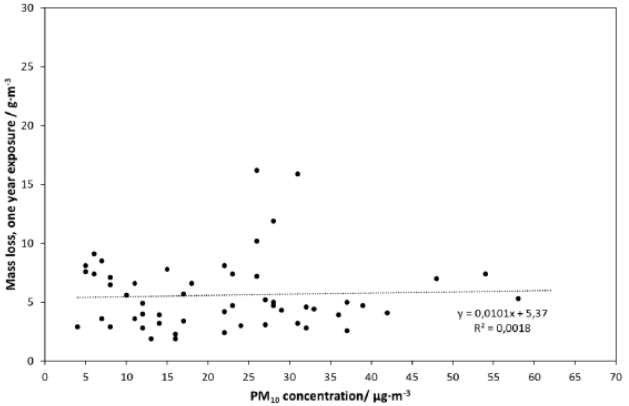


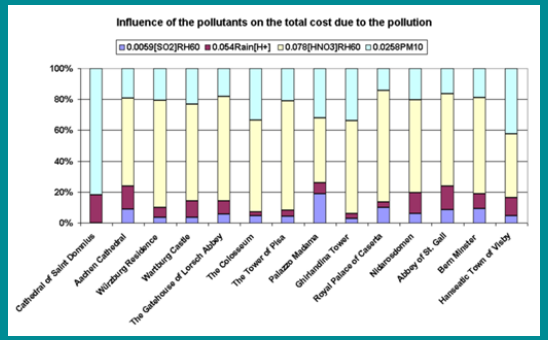
Figure 35 Linear regression between one-year mass loss of copper and PM_{10} concentration during 2002-2017

Copper

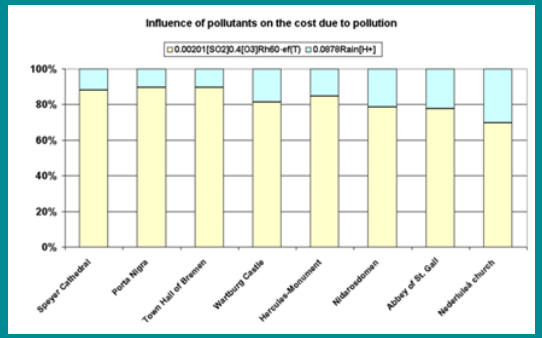
Gathering information on policy-relevant user-friendly indicators to evaluate air pollution effects on materials by conducting case studies on UNESCO cultural heritage sites

Report 89

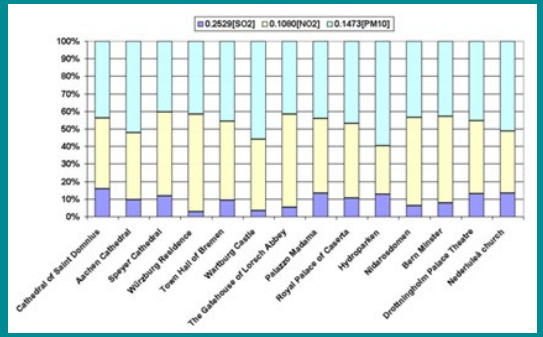
UNESCO - Relative importance of individual pollutants on the estimated mainteinance/repair cost



Limestone recession



Copper corrosion



Glass soiling

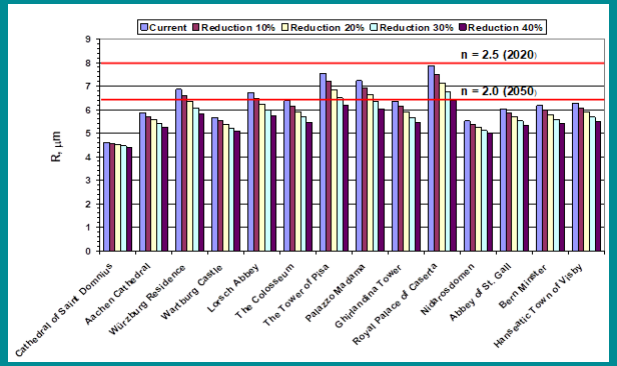
Limestone recession: 60% attributable to HNO_3; important contribute of Pm_{10}.

Copper corrosion: attributable to the combined effect of SO_2 and O_3.

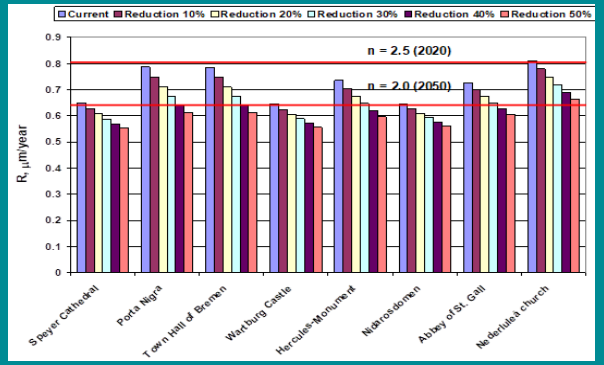
Glass soiling: PM_{10} and NO_2 contribute to about 90% of the cleaning cost of glass surfaces, almost divided between the two pollutants.

Limestone soiling: PM_{10} only damage agent considered

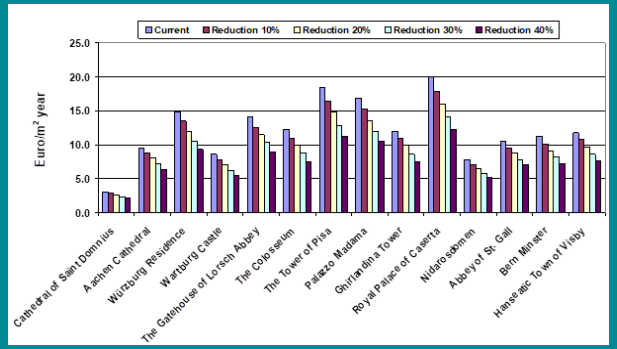
UNESCO - Pollutant reduction:effect on the cost



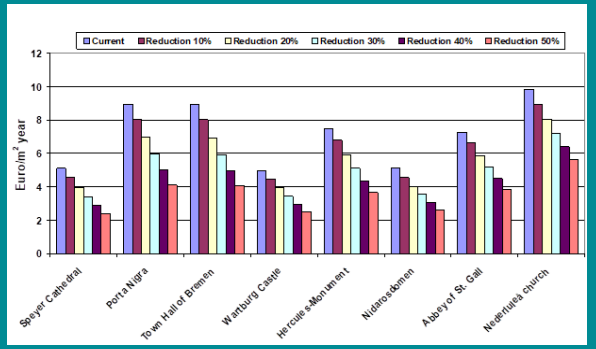
Limestone: surface recession rates reduction



Copper: corrosion rates reduction



Limeston recession: pollution costs reduction



Copper corrosion: pollution costs reduction

Depending on monuments and enviromental conditions, 2050 target is achieved by pollutants reduction of 20-50% that allows a saving in mantainance/repair cost due to air pollution of 32-40% for both Limestone recession and Copper corrosion.

36th meeting
May 6-8, 2020, Teams

There were total of 24 participants from 13 countries, including the chair and secretariat of the working group on effects.
Separate sessions, general and

- Exposure for trend analysis
- Update of mapping manual
- Update of dose-response functions for zinc
- Measurements for evaluation of chloride deposition
- UNESCO Cultural heritage sites

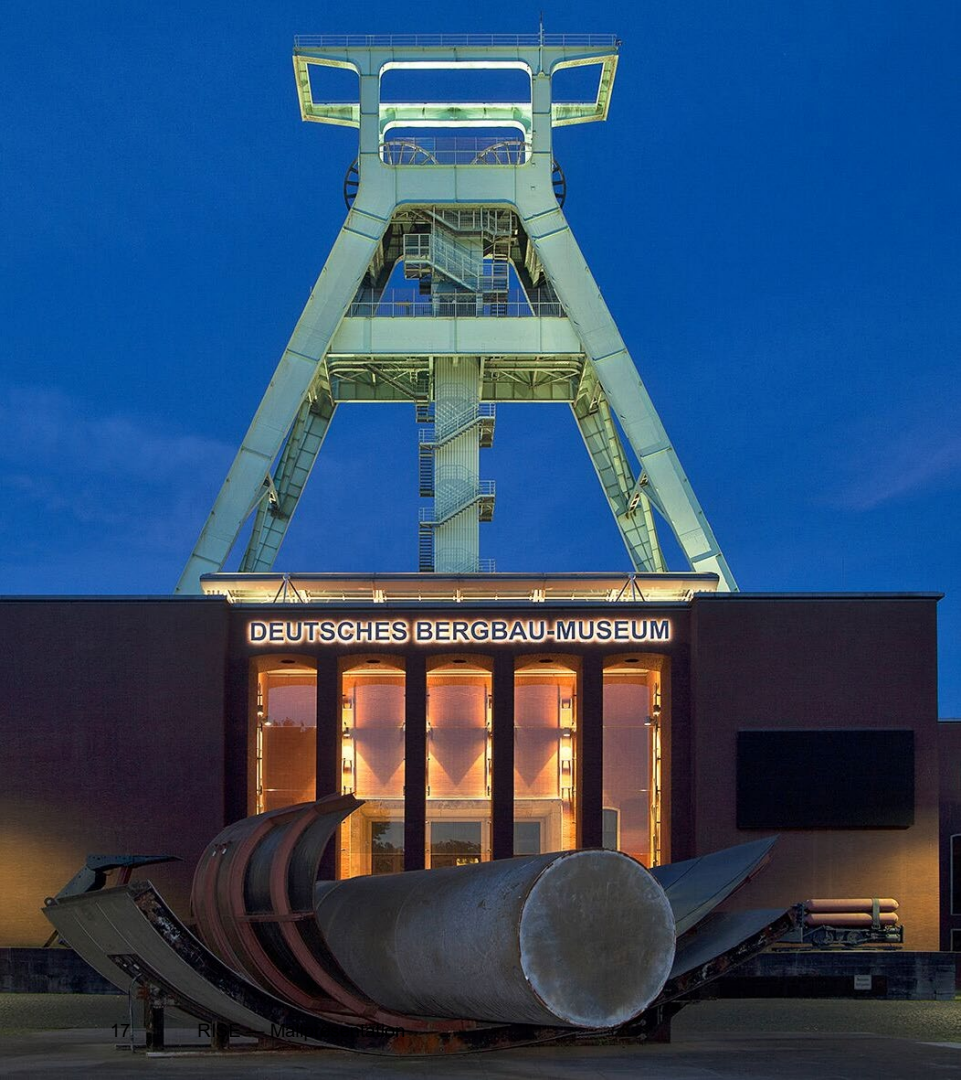
Summary (as text) – 1(2)

1. The Head of ICP Materials reported on developments and the outcomes of the thirty-sixth meeting of the ICP Materials Task force (Teams, 6-8 April 2020). The main items discussed at the meeting were:
   a) Trends in pollution, corrosion and soiling;
   b) Update of the mapping manual to include soiling; and
   c) The call for data on UNESCO cultural World Heritage Sites.

2. Results from the recent trend analysis (1987–2019) show that acidification (SO_2) still plays a role for corrosion, but minor, and ozone is of minor importance for the corrosion of copper. There has not been possible to show any effect of PM on corrosion, but the effect on soiling (modern glass, coil coated materials) is high and significant. There is no decreasing trend in soiling of modern glass, which is one of the new materials to be included in the future update of the mapping manual to include soiling for the first time. A new exposure for trend analysis will start in 2020 with one- and four-year samples withdrawal in 2021.

Summary (as text) – 2(2)

3. At United Nations Educational, Scientific and Cultural Organization (UNESCO) cultural World Heritage Sites, the recession, estimated from present dose-response functions, and the consequent estimated maintenance/repair cost of calcareous stone materials seems to be dominated by the presence in the atmosphere of HNO_3, and PM_{10}. Copper corrosion is dominated by SO_2 and O_3 combined effect (dry deposition). PM_{10} and NO_2 contribute to glass soiling for about 90%. PM_{10} is the only pollutant considered for limestone soiling. A decrease in the concentrations of NO_2 in the atmosphere could bring benefits in reducing the damage and therefore the cost of the damage of the corrosion of the limestone and in the soiling of the glass . A decrease in the concentrations of PM_{10} could bring benefits in reducing the damage and the cost in corrosion and soiling of limestone and soiling of glass.



37th meeting
May 5-7, 2021

Welcome to Bochum and the German mining Museum!

We hope to have the meeting next year that we could not have this year!