ICP Materials

Progress in activities in 2022 and future work

8th Joint Session of the EMEP Steering Body and Working Group on Effects
12 September - 16 September 2022

Contents

- Overview of progress in work plan items 2021 – 2022
- Progress of work plan items 2022
  - Trend exposure
  - UNESCO Call for data
- 2022 and 2023 meeting of the task force
- Summary of main messages (as text for minutes)

Progress in work plan items, ECE/EB.AIR/2021/2: Draft 2022–2023 workplan for the implementation of the Convention

- 1.1.1.9 Impact of corrosion and soiling including trends
  - Report of corrosion and soiling data from the exposure for trend analysis 2017-2021 (2022)
  - Environmental data report (2023)
  - Report of trends in corrosion, soiling and pollution 1987-2021 (2023)
- 1.1.1.10 Policy-relevant user-friendly indicators (UNESCO sites)
  - Report on Call for Data – Part VI: Study on the relationship between the environmental and the artefact on selected UNESCO sites (2022)
  - Report on Call for Data – Part VII: Application of models with increased resolution on selected UNESCO sites (2023)

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

Recent progress of the trend exposure

Summary of exposures

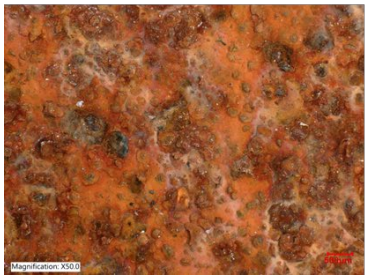
- Evaluation of 1-year exposures (2020-2021) and 4-year exposures (2017-2021) for corrosion of materials.
- Evaluation of soiling materials (2020-2021)
- Start of parallell exposure of carbon steel and weathering steel 2021-2029
- This year only corrosion data, next year trends in corrosion, soiling and environmental data

Carbon steel – polluted sites

test site 10

test site 3

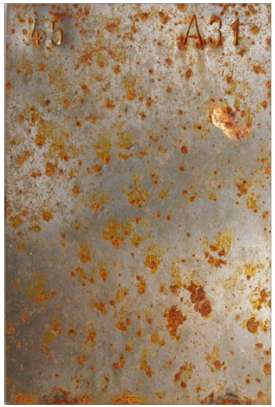
test site 41



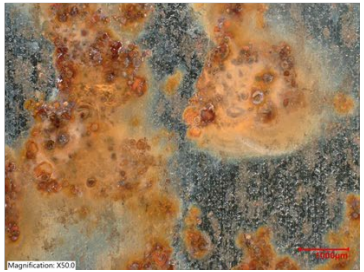
Carbon steel – unpolluted sites

test site 33

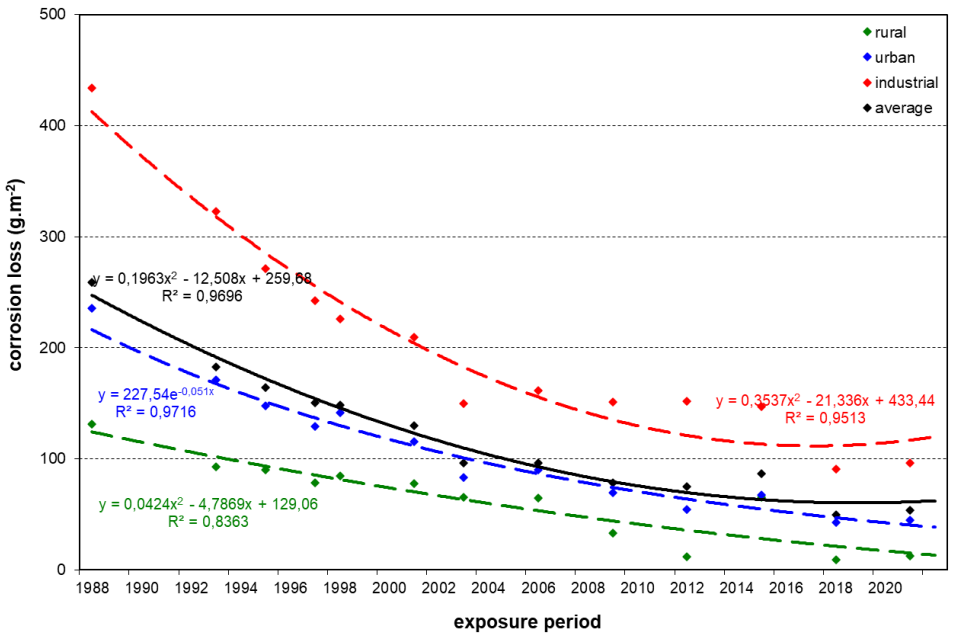
test site 31



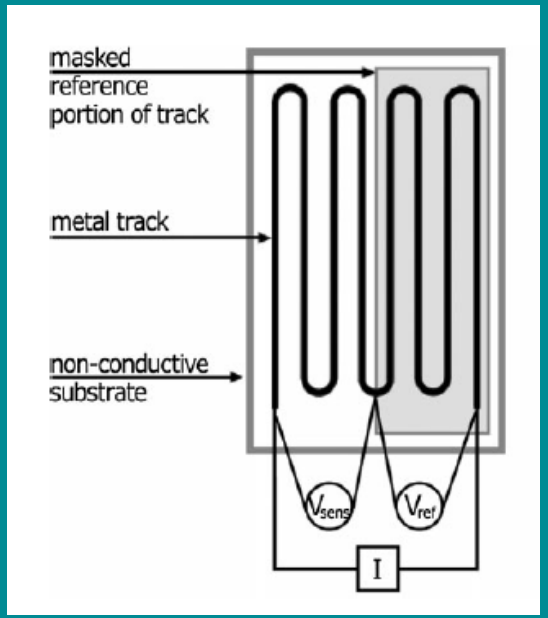
test site 45



Carbon steel – difference between polluted and unpolluted sites



Obtaining time-resolved data on corrosion attack on carbon steel

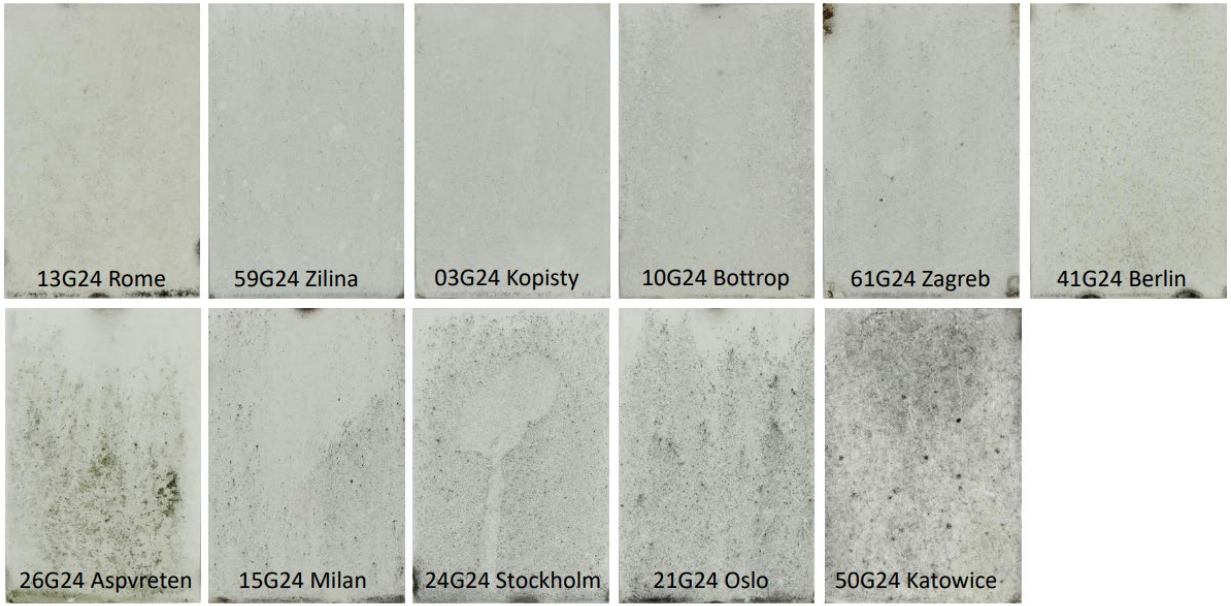


- When the sample corrode the thickness of the metal track will decrease and the resistance will increase giving the possibility to log corrosion attack day by day
- Discussion at task force about the possibility to introduce ”level 2 sites” or ”super sites” in the network of test sites

Example of results

- Identification of times when corrosion is high
- Comperison with episodes (temperature, relative humidity, pollution)

Soiling of coil coated materials



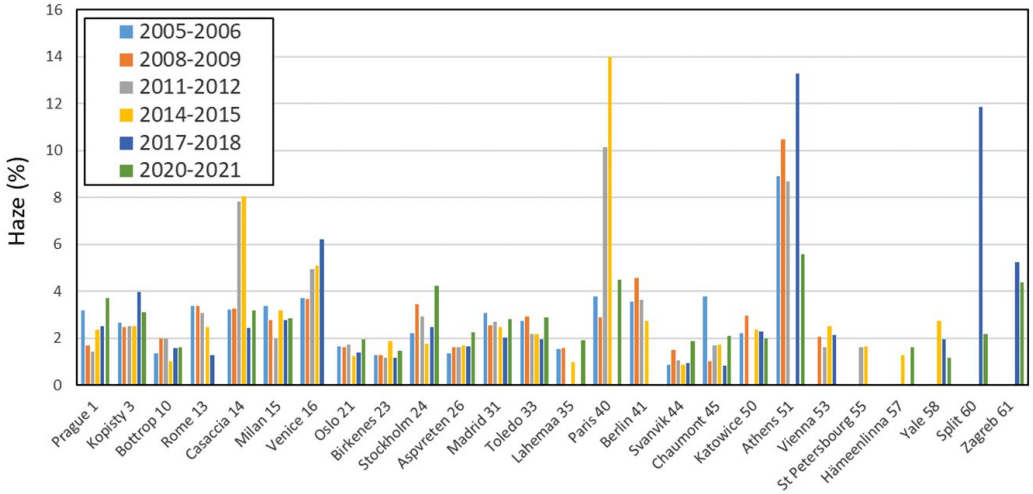
HAMK HÄMEEN AMMATTIKORKEAKOULU
HÄME UNIVERSITY OF APPLIED SCIENCES

After 4 years soiling is evident

(not so after 1 year)

RI. SE

Soiling of modern glass

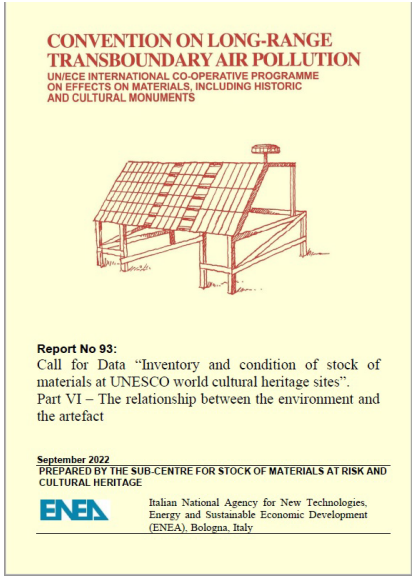


- Consistent new results with haze which can be used to validate the dose-response function in the updated mapping manual

Report on Call for Data

ICP Materials Report 93

Call for data “Inventory and condition of materials at UNESCO world heritage sites”. Part VI. Study on the relationship between the environment and the artefact on selected UNESCO sites .



The relationship between the environment and the artefact

The relationship between the environmental context surrounding some selected UNESCO sites and the air pollution responsible for the corrosion and soiling effects of the material is investigated. Three different sites were chosen on the basis of their different estimated cost due to air pollution for the materials of the

	Limestone (corrosion)	Limestone (soiling)
St. Domnius Cathedral	Low	Medium
Würzburg Residence	Medium	Medium
Royal Palace of Caserta	Very High	High/Very High

Range time investigated: years 2015-2019

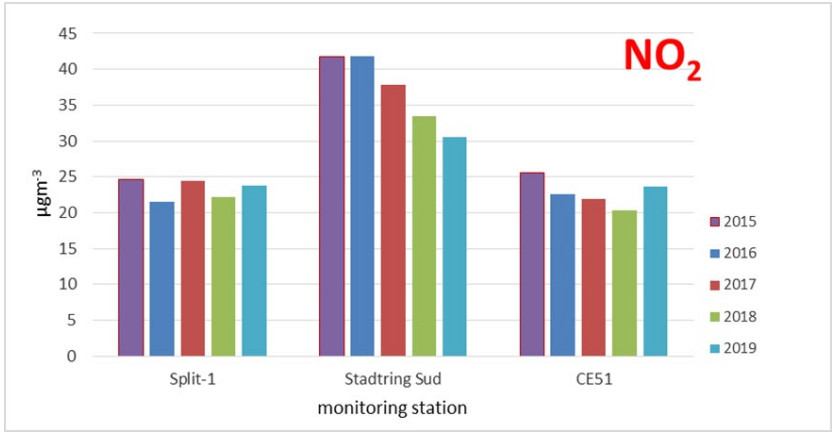
RI. SE

NO_2 Emissions

	SPLIT		WÜRZBURG		CASERTA	
	2015	2019	2015	2019	2015	2019
	Mg	Mg	Mg	Mg	Mg	Mg
A- PublicPower			215.38	81.97		
B- Industry	1644.85	940.11	164.74	158.18	2362.31	2037.25
C- OtherStationaryComb	39.83	35.45	129.58	128.38	196.16	193.24
D- Fugitive			0.55			
E- Solvents	0.61	0.88	0.38	0.35	0.47	0.43
F- RoadTransport	337.61	341.78	564.69	423.26	660.41	507.59
G- Shipping	135.73	161.75	26.50	24.60		
I- Offroad	61.52	48.51	47.03	39.59	54.19	40.06
J- Waste	0.08		0.32	0.29	3.99	0.69
K- AgriLivestock	3.26	0.07	0.45	0.43		
L- AgriOthe		3.62	13.43	11.78		
Total	**2223.48**	**1532.18**	**1163.05**	**868.82**	**3277.54**	**2779.26**

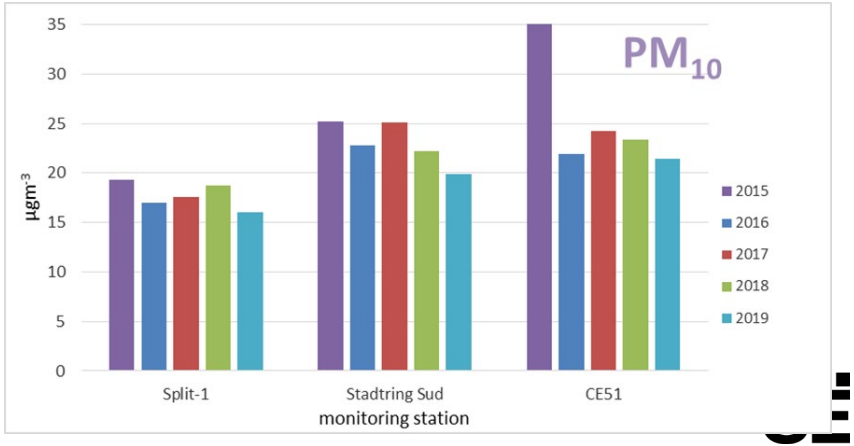
source: EMEP/CEIP

Air pollutants data

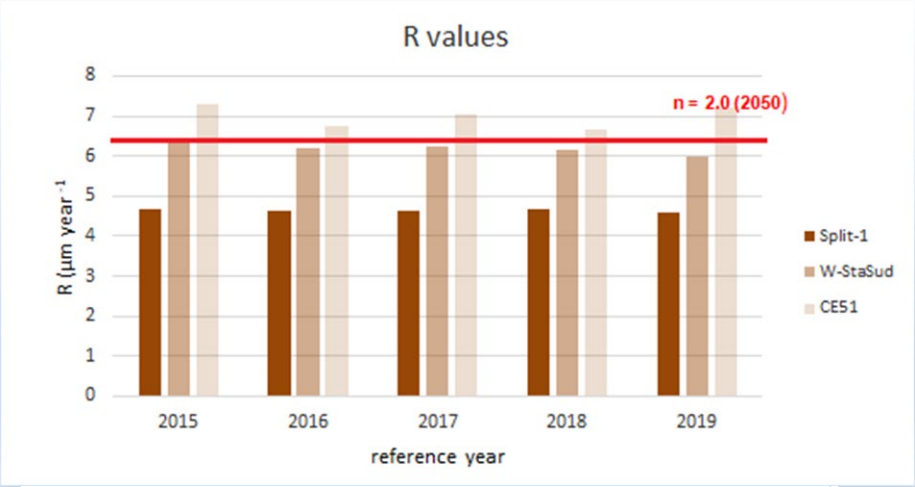


PM_{10} Emissions

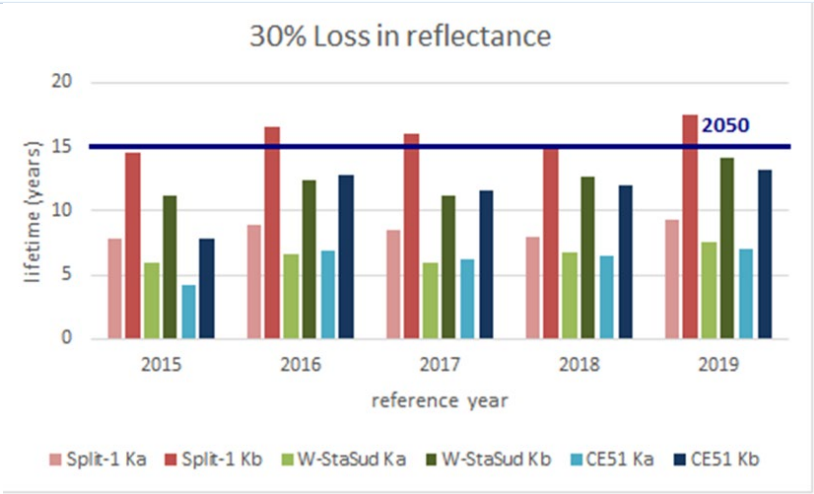
	SPLIT		WÜRZBURG		CASERTA	
	2015	2019	2015	2019	2015	2019
	Mg	Mg	Mg	Mg	Mg	Mg
A- PublicPower			4.63	2.95		
B- Industry	251.17	239.70	55.40	57.02		
C- OtherStationaryComb	100.95	81.71	41.00	35.62	90.48	79.63
D- Fugitive					1.68	
E- Solvents	13.61	20.51	8.39	7.62	8.16	6.99
F- RoadTransport	22.37	19.95	33.34	30.45	39.47	31.76
G- Shipping	2.59	3.09	1.03	1.03		
I- Offroad	3.01	2.11	5.60	4.95	4.70	2.79
J- Waste	6.01	6.39	6.62	6.29	9.87	6.33
K- AgriLivestock	0.65	0.54	2.84	2.67	0.56	0.56
L- AgriOthe	1.46	1.43	2.59	2.55	3.17	3.20
Total	**401.83**	**375.43**	**161.44**	**151.14**	**158.10**	**131.26**



source:



$$R = 4.0 + 0.0059[SO_2]Rh60 + 0.054Rain[H+] + 0.078[HNO_3]Rh60 + 0.0258PM_{10}$$



$$\Delta R/Ro = 1 - \exp(-PM_{10} \times t \times K)$$

$Ka = 6.5 \times 10^{-6}$ (not official)

$Kb = 3.47 \times 10^{-6}$ (Polycarbonate Membrane Material)

COMMENTS

- ✓ **Total emissions: decreasing**
- ✓ **NO_2 and PM_{10} concentrations: light decreasing.**

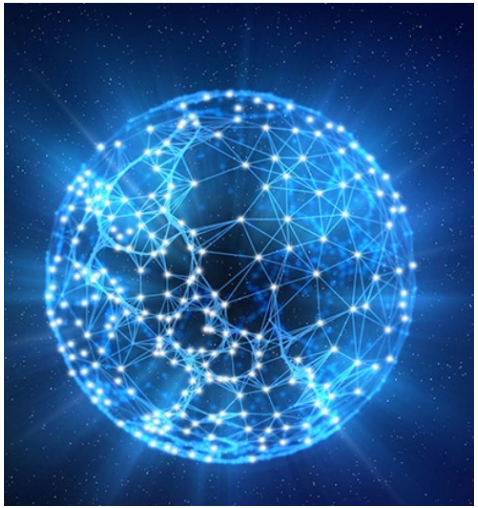
- ➢ **Not observed a real trend for R and ΔR/Ro (more or less same values in 2015-2019)**
- ➢ **R values below 2050 target (6.4 μm $year^{-1}$) except for Caserta**
- ➢ **Years number to reach 30% loss of reflectance increasing but far from 2050 target (15 years) except for Split considering the lower value for soiling K**

- ❖ **Despite the decrease in emissions in recent years and the slight decrease in the concentrations of atmospheric pollutants, the materials of the cultural objects studied are still partly at risk**

RI.
SE

38th meeting ICP Materials May 4-5, 2022

Virtual meeting with participants from Austria, Croatia, Czech Republic, Estonia, Finland, France, Germany, Greece, Italy, Narway, Poland, Spain, Sweden, Switzerland, UK, chair of WGE, representative of TFICAP and IVL Swedish Environmental Research Institute



Main items discussed at the meeting

- Information from WGE including GP review (later in agenda) / science strategy
- Information from TFICAP (Task Force for International Cooperation on Air Pollution)
- Discussion of data access (later in agenda)
- Corrosion and soiling data from the exposure concluded in 2021
- UNESCO cultural heritage sites including upscaling of economical evaluations
- Approval of final update version of Mapping Manual Ch 4 to include soiling
- Discussion on need for updating dose-response functions
- Discussion of possibility to expand the scope to ”level 2 sites” (2024-2025 work plan)

39th meeting
May 3-5, 2023

Welcome to Bochum and the German mining Museum!

(This meeting was first scheduled in 2020)

RI.
SE

Summary for minutes (as text)

1. The Head of ICP Materials programme Centre reported on developments and the outcomes of the progress of activities including update on the on-going exposure for trend analysis and status on the case studies on UNESCO cultural heritage sites.

2. Results of corrosion and soiling data after withdrawal in 2021 is now available for carbon steel, weathering steel, zinc, aluminium (corrosion) and modern glass, limestone, marble and coil coated materials (soiling). A trend analysis including the new data and environmental data will be presented in 2023. A new exposure has also started with the aim of comparing long term data (2021-2029) for weathering steel and carbon steel.

3. Present analysis of data collected at UNESCO sites presented this year includes a study on the relationship between the environment and the artefact on three selected UNESCO sites: St. Domnius Cathedral, Würzburg Residence and Royal Palace of Caserta. Despite the decrease in emissions in recent years and the slight decrease in the concentrations of atmospheric pollutants, the materials of the cultural objects studied are still partly at risk.