

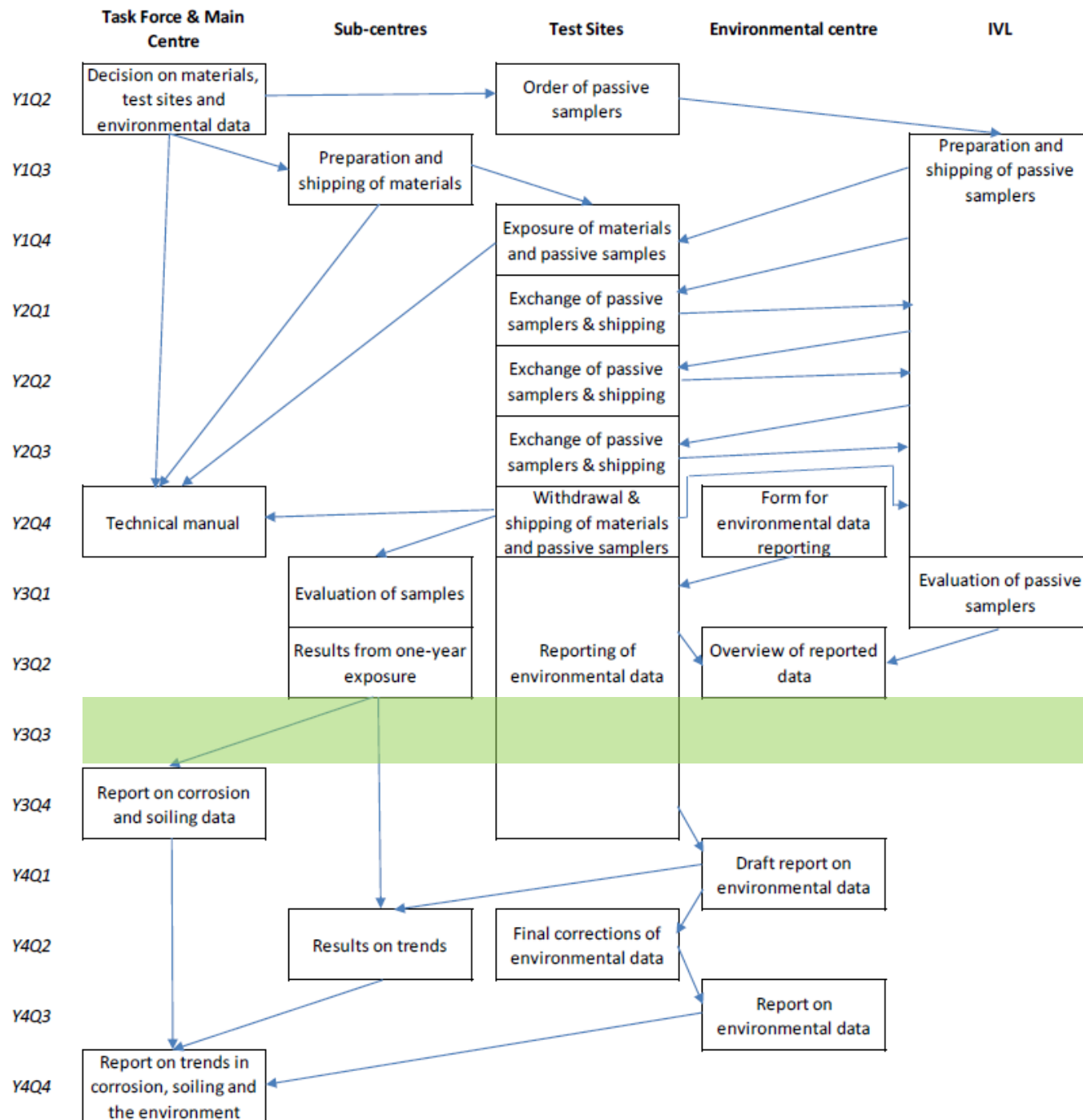
ICP MATERIALS

Research Institutes of Sweden

DIVISION Material o produktion

Workplan 2018-2019 (ECE/EB.AIR/2017/1)

- 1.1.1.8 Monitoring and assessment of the impact on the environment of corrosion and soiling effects on materials and their trends
 - Technical manual (2018) - OK
 - Corrosion and soiling data (2019)
 - 1.1.1.9 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 on risk assessment (2018) - OK
 - Report on economic evaluation (2019)
 - 1.4 Improving the functioning of WGE and EMEP and their subsidiary bodies
 - Possible collaboration ICP materials – EMEP
 - 1.4.3 Develop a common portal to enable integrated assessments and to assist Parties in their implementation of air pollution strategies
- Reports (2018-2019) available on the ICP Materials web page
 - Report No 83: Call for Data “Inventory and condition of stock of materials at UNESCO world cultural heritage sites”. Part II – Risk assessment (September 2018)
 - Report No 84: Technical manual for the trend exposure programme 2017-2018 (November 2018)



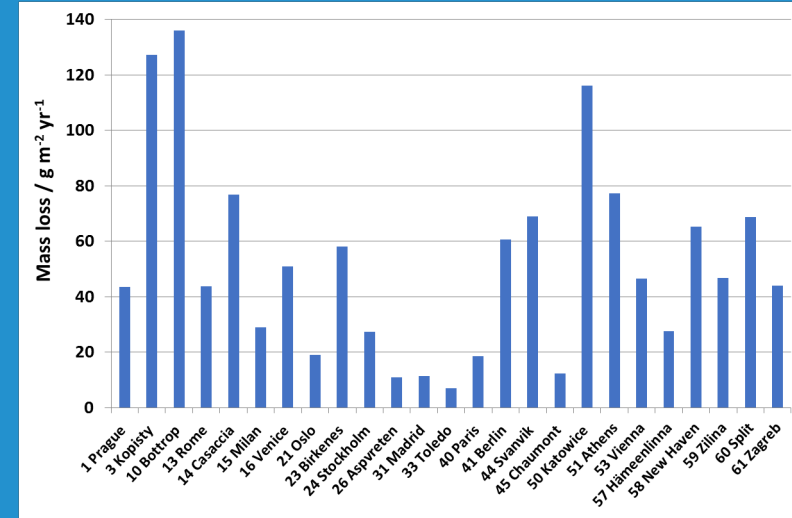
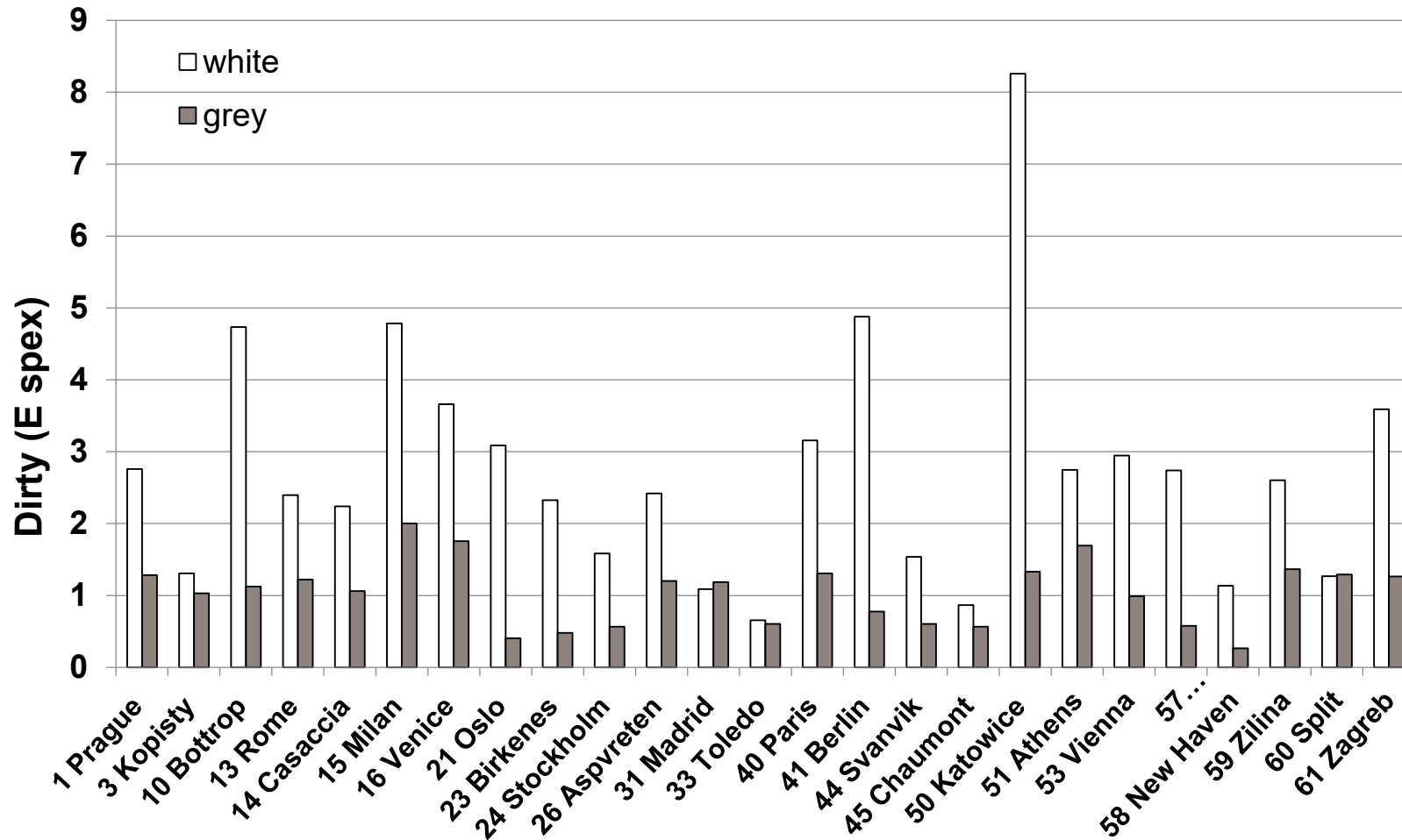
- 1.1.1.8 Monitoring and assessment of the impact on the environment of corrosion and soiling effects on materials and their trends:
- Exposure on schedule
- Next step results from one-year corrosion and soiling data to be reported

Balance between corrosion and soiling

Period	Corrosion	Soiling
1987-1994	Carbon steel, weathering steel, zinc, aluminium, copper, bronze, limestone, sandstone, electric contact materials	Painted steel and wood (PM not measured)
1997-2003	Carbon steel, zinc, copper, limestone, Medieval glass, polymer materials	Painted steel (PM not measured)
2005-2015	Carbon steel, zinc, limestone	Modern glass
2017-2018	Carbon steel, zinc, copper, limestone	Modern glass, coil coated steel, white and grey, limestone and marble

- With the 2017-2018 exposure the number of materials exposed for corrosion and soiling is for the first time balanced

Data now available for these materials



Report 85 (forthcoming):

- Soiling data for coil coated materials (left)
- Corrosion data for carbon steel (top)
- Corrosion data for zinc, weathering steel, copper, limestone
- Soiling data for glass, limestone and marble

UNESCO studies - Lifetimes of the materials

Material (risk)	Tolerable damage before action	Lifetime in the background atmosphere	Lifetime in the actual atmosphere
Limestone (recession)	100 μm	114 years	22 - 67 years
Copper (corrosion)	10 μm	80 years	21 - 33 years
Limestone (soiling)	35% loss of reflectance	14 years	4.5 - 15.1 years
Glass (soiling)	1% haze (preliminary)	270 days	99 - 390 days

Lifetimes under the current air pollution are generally much shorter than in a background scenario. This means a higher maintenance frequency which translates into higher costs.

UNESCO studies - Additional cost due to current air pollution

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 (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)
Other natural and artificial stone materials including sandstone (soiling)	25	0 - 34.8	0 - 58 (average: 21)
Glass (soiling)	6.8	0 - 11.7	0 - 63 (average: 33)

Costs due to the corrosion of materials from air pollution represent on average 71% of the total cost for the recession of the limestone and 66% for the corrosion of copper.

Costs due to the soiling of materials from air pollution represent on average 35% of the total cost for the soiling of the limestone and 33% for the soiling of glass.

UNESCO studies - Additional cost due to current air pollution

Table 20. Cost due to air pollution above the background scenario for the materials of the façade of the monuments.

Name of the cultural object	Material (risk)				
	Limestone (corrosion)	Limestone (soiling)	Copper (corrosion)	Glass (soiling)	Other stone materials (soiling)
Cathedral of Saint Domnius	Low	Medium		Low	Low
Aachen Cathedral	Medium	Low		Low	Medium
Speyer Cathedral			Medium	Low	High
Würzburg Residence	Medium	Medium		Medium	High
Porta Nigra			Low		Medium
Town Hall of Bremen			Medium	Low	Medium
Wartburg Castle (palace and keep)	Low	Low	Low	Low	Medium
Hercules Monument			Low		High
The Gatehouse of Lorsch Abbey	Low	Low			Low
The Colosseum	High	High/Very high			
The Tower of Pisa	High	High			
Palazzo Madama	Medium	High		Low	High
Ghirlandina Tower	Medium	Medium/High			Low
Royal Palace of Caserta	Very high	High/Very high		Medium/High	High/Very high
Hydroparken				Low	Low
Nidarosdomen	Low	Low	Low	Low	Low
Drottningholm Palace Theatre				Low	Low
Nederluleå church			Low	Low	Low
Wall of the Hanseatic Town of Visby	High/Very high	Very high			High
Towers of the cathedral of the Abbey of St. Gall	Low	Low	Low		Low
Bern Minster	Low	Low		Low	Medium

Note: low = hundreds or thousands of Euro/year; medium = tens of thousands of Euro/year; high = hundreds of thousands Euro/year; very high = approaching or exceeding one million Euro/year.

For monuments with a large surface area, the expected cost of damage attributable to atmospheric pollution is in the order of hundreds of thousands of Euro per year or approaching or even exceeding one million Euro per year.

35th Meeting, University of Paris-Diderot



- 21 participants
- Croatia, Czech Republic, Finland, France, Germany, Italy, Norway, Spain, Sweden, Switzerland, United Kingdom.
- Chair of the Working Group on Effects

Workplan 2020-2021 (Proposal)

- 1.1.1.8 Monitoring and assessment of the impact on the environment of corrosion and soiling effects on materials and their trends
 - Environmental data report (2020)
 - Report of trends in corrosion, soiling and pollution 1987-2019 (2020)
 - Technical manual 2017-2021 (2021)
 - Revision of mapping manual to include soiling (2021)
- 1.1.1.9 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 focused on the relative importance of individual pollutants on the cost of damage for selected UNESCO sites (2020)
 - Report on application of models with increased resolution (1km x 1km) at selected UNESCO sites (2021).

36th Meeting of the Task Force



- May 6-8, 2020
- Welcome to Bochum and the German Mining Museum!
- Practical Information on the ICP Materials home page (forthcoming)