

CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

International Co-operative Programme on
Effects on Materials, including Historic and Cultural Monuments

Minutes for
37th Meeting of the Programme Task Force

The meeting was held on 5-6 May 2021 with several independent sessions taking place on Teams. There were total of 26 participants from 16 countries, including the chair of the working group on effects. All participants joined the meeting at different sessions depending on their responsibilities. All presentations presented in the meeting can be found at Teams in the ICP Materials group. For further assistance concerning presentation files, please contact [namurata.palsson@ri.se](mailto:namura.palsson@ri.se).

Session overview

Date	Time	Topic
May 5	9:00-10:30	General Session 1 (2)
	10:45-12:00	Exposure programme 2020-2025
	13:30-15:00	Exposure programme 2020-2025 (contd.)
	15:15-16:30	Update of Mapping Manual Ch 4 to include soiling
May 6	9:00-10:30	Update of dose-response function for each material
	10:45-12:00	Update of dose-response function for each material (contd.) UNESCO Cultural heritage sites
	13:30-15:00	UNESCO Cultural heritage sites (contd.)
		General session 2 (2)

Wednesday May 5**09:00-10:30 General session 1(2)****1. Test of the meeting system 09:00-09:15**

At 09:00 participants started to join the meeting

2. Opening of the meeting

Johan started the meeting by welcoming all participants and giving practical information.

3. Introduction of participants

Manfred Schreiner, Austria

Ivona Igric, Croatia

Katerina Kreislova, Czech Republic

Tiina Vuorio, Finland

Aurelie Verney-Carron, France

Stefan Brüggerhoff, Germany

Ruth Keller, Germany

Faiz Al Sharif, Germany

Maja Vijver, Germany

John Christodoulakis, Greece

Pasquale Spezzano, Italy

Teresa La Torretta, Italy

Terje Grøntoft, Norway

Lech Kwiatkowski, Poland

Rafal Lutze, Poland

Daniel Kajaneek, Slovakia

Daniel de la Fuente, Spain

Johan Tidblad, Sweden

Namurata Pålsson, Sweden

Markus Faller, Switzerland

Ulrik Hans, Switzerland

Tim Yates, UK

Mariana Di Giacomo, USA

Isaura Rabago (chair of Working Group on Effects)

Marta Segura Roux (IVL Swedish Environmental Research Institute)

Vasile Rus (observer)

Note: the list above includes all participants joining the meeting in at least one of the sessions listed above. All names appear according to alphabetical order of their countries or responsibility in the meeting.

4. Overview of meeting objectives and approval of the agenda

Johan presented an overview of the agenda of the current meeting. The agenda was approved without additions.

5. **Information from the joint meeting of EMEP & WGE**

Isaura gave an update of current WGE and Convention issues from recent meetings including latest news and topics addressed from CLRTAP meetings.

a. **Information on Gothenburg Protocol Review**

Johan gave a brief introduction to the Gothenburg Protocol Review including the addressed questions. The factsheet must be submitted by the end of July this year. Concerning question on more data for the projected trend, Isaura mentioned that more discussion with all ICPs is still needed to provide timeline. The factsheet should highlight the information to policy makers.

6. **38th and 39th meeting of the Programme Task Force**

Johan invited Stefan to give details on the next meeting. Stefan said that all participants are welcome to Bochum for 38th Meeting of the Programme Task Force even though he is retiring this year. The tentative date for the meeting in Bochum is May 4-6, 2022 (subjected to confirmation). There was no discussion on 39th meeting.

7. **Tour de table; Current financial situation and Corona situation affecting possibilities to perform tasks**

All participants presented an overview of the funding situation and how the corona virus situation affects the work. In summary, the situation is stable and accessing the test sites is possible.

Johan mentioned that the contract for Sweden (#24 and #26) has been approved for 3 years with possibility of extension of 2 years. Test rack at Aspveten (#26) has been restored and all environmental parameters are measured on-site. Visiting test sites is possible.

Katerina mentioned that contract for Prague (#1) and Kopisty (#3) sites are yearly and it is in preparation for this year. The financial covers most of the work. Visiting test sites is possible.

Stefan mentioned for test sites in Germany (#10 and #41), the financial contract has been approved until 2023 and covers most work. Visiting test sites is possible.

Teresa mentioned that financial situation is as usual. Visiting test sites was restricted earlier, but it is possible now.

Terje mentioned that financial support for test sites in Norway (#21, #23 and #44) is yearly and it has been approved for this year. Visiting test sites is possible.

Daniel de la Fuente mentioned that financial support had been approved for 2020-2021. Visiting test site in Madrid (#31) is possible, but not in Toledo (#33). The rain data was missing at Madrid during October-November 2020, but it is available for Toledo.

Aurelie mentioned that there is no additional financial support for test site in France (#40), but there is budget from a research project that covers the work. Visiting test site is possible. Black carbon measurement has been started.

Markus mentioned that the contract for financial support for test site in Switzerland (#45) is yearly and has been approved for this year. Visiting test site is possible.

Rafal mentioned that the contract for financial support for test site in Poland (#50) is still under processing for approval. Visiting test site is possible.

John mentioned that the financial support for test site in Greece (#51) has been approved for this year, however for next year there may not be any financial support

for travelling. The test rack may have to be moved due to the access to the building. Visiting test site is currently possible.

Manfred informed that he will be retired this year and Michael will continue maintaining the site (#53). The test rack was restored. There is no financial support or research project for the work, however the contribution from test site will continue. Visiting test site is possible.

Tiina mentioned that test site in Finland (#57) is financially supported by related project. Visiting test site is possible.

Marianna mentioned that test site in USA (#58) is financially supported by Yale University and visiting test site is possible.

Daniel Kajanek mentioned that there is no specific project to support test site in Slovakia (#59), but there is budget to continue the contribution. Visiting test site is possible.

Ivona mentioned that there is no specific funding to support the test sites in Croatia (#60 and #61). Test rack at Split (#60) went missing, but later has been restored. Visiting test sites is possible.

Tim mentioned that it was not possible to provide limestone material for exposure in 2020, but it will be possible in October this year.

Wednesday May 5 (contd.)

10:45-12:00 Exposure programme 2020-2025

8. Reporting requirements

a. Report 91: Technical Manual for the trend exposure programme (2017-2021)

Namurata presented the draft of Report 91. Tiina mentioned that for white (G) and grey (H) coil coating exposed in October 2020 (G34 and H34) the exposure will be either 3 or 4 years depending on the results that will be obtained from G24 and H24 in October this year. Stone samples for soiling (O31-34 and P31-34) will be collected yearly – one sample each year in 2021-2024. Aurelie will send additional boxes to all sites before September 2021 and detailed instruction on how to disassemble only one sample will be added in Report 91.

Terje mentioned about sunshine in Table 4 in Report 91, that it should be reported as energy. Tiina suggested to add additional table in Report 91 for centrally collected parameter since she is currently collecting data on sunshine. All agreed that sunshine duration (SD) in hours in Table 4 in Report 91 should be changed to sunshine radiation (RAD) in W/m^2 . Tiina will collect data on sunshine radiation and communicate directly to Terje on how to report this parameter.

Katerina mentioned about adding Cl^- deposition from wet candle method as optional parameter to obtain data of airborne salinity. The data should be collected every month, not every three months. Otherwise, dry gauze method could work. However, the quality of dry gauze is of highly concerned. Katerina will add the text on wet candle method in Report 91. Each test site can perform their own analysis for chloride concentration from the wet candle. Daniel also agreed with Katerina that exposure of wet candle for 3 months is too long for certain test sites, based on his study. Nevertheless, test site who will perform wet candle measurement is encouraged to do the comparison of exposure of 1 and 3 months in parallel for the first year.

Aurelie mentioned about data of rainy days before collection of coil coated samples, but Tiina mentioned that there is no correlation of number of rainy days and soiling of the samples.

9. Environmental data report

Terje showed tables for environmental data reports. It was suggested that the data should be reported when passive samplers are exposed. Temperature and relative humidity should always be reported even on the year that passive samplers are not exposed.

a. IVL passive samplers

Marta presented an introduction to passive samplers. It is recommended that the samplers should be send back to IVL as soon as possible after collection. O_3 sampler with 10 mm length cannot be exposed for 3 months. When sending passive samplers back to IVL, private company is preferred. When stored passive samplers before exposure, keep them in the envelop. After collecting the samplers, make sure that the lid is closed properly.

For the exposure during January-March 2021, all sites got 10 mm O_3 samplers. For exposure during April-July 2021, 10 mm O_3 samplers were sent out by IVL. IVL will send 30 mm O_3 samplers to all sites again by week 19. Those who have not exposed O_3 samplers for April-July 2021 are recommended to wait for 30 mm O_3 samplers. Those

who has already exposed 10 mm O₃ samplers (Finland, Norway, and Switzerland) are recommended to exposed 10 mm O₃ sampler for 1 month and then change to 30 mm sampler for 2 months. However, the 10 mm O₃ samplers must be sent back to IVL as soon as possible after collection. After sending 30 mm O₃ samplers, IVL will also send an invoice to all sites. Test sites who wish to get an invoice later should contact Marta directly.

Marta requested that all sites must provide average temperature during exposure of passive samplers by noting it in the form and signed by those who collect the samplers. Precise average temperature will be provided later by Terje. John informed that site No 51 does not expose IVL passive samplers.

Wednesday May 5 (contd.)

13:30-15:00 Exposure programme 2020-2025 (contd.)

10. Report of exposure 2020 from all sites

Namurata presented the date where all samples were exposed at each test sites (see details in Table 2 in Report 91) and photos from test sites. Photos from test sites from Austria, Spain, and Italy were sent to Namurata, but were missing in the presentation. They will be later added in the presentation. Terje presented some changes at Norway sites. Katerina pointed out that coil coated samples at site No 58 were up-side down. Tiina informed that this should be changed immediately with note taken when sending samples back to sub-centre.

11. Decision on materials to be exposed 2021-2025: 4-year trend exposure, including numbering of samples of carbon and weathering steels (2021-2025), and one-year trend exposure of limestone (2021-2022)

Namurata presented samples to be exposed from 2021, below. Carbon steel (A) and weathering steel (B) will be exposed for 1, 4 and 8 years at all 25 sites in 2021 with following sample labels:

1-year samples: 41-43

4-year samples: 44-46

8-year samples: 47-49

Limestone (M) 1-year exposure was postponed from October 2020 to October 2021. The sample labels for limestone are M31-33.

Material	Period (y)	2017-	2018-	2019-	2020-	2021-	2022-	2023-	2024-	2025-	2026-	2027-	2028-	start oct
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	end oct
Carbon steels A	1				3	3		3						1 year
	4	3	3	3	3		3	3	3	3				2 years
	8					3	3	3	3	3	3	3	3	3 years
Stainless steels S	1													4 years
	4	3	3	3	3									8 years
	8													
Weathering steel B	1					3								
	4	3	3	3	3		3	3	3	3				
	8					3	3	3	3	3	3	3	3	
Zinc (cast) D	1				3			3			3			
	4	3	3	3	3			3	3	3	3			
	8													
Zinc (titanium) C	1				3			3			3			
	4							3	3	3	3			
	8													
Copper E	1							3			3			
	4													
	8													
Aluminium V	1													
	4	3	3	3	3			3	3	3	3			
	8													
White CC G	1							1						
	3				1	1	1							
	4	1	1	1	1			1	1	1	1	1		
	8				1	1	1	1	1	1				
Grey CC H	1							1						
	3				1	1	1							
	4	1	1	1	1			1	1	1	1	1		
	8				1	1	1	1	1					
Modern glass T	1				1			1						
	2													
	3													
	4													
Limestone O	1				1			1						
	2				1	1								
	3				1	1	1							
	4				1	1	1	1						
Marble P	1				1			1						
	2				1	1								
	3				1	1	1							
	4				1	1	1	1						
Limestone M On carousel	1					3		3			3			
	4	3	3	3	3			3	3	3	3			
	8													

In 2021, 4-year samples of cast zinc (D) labeling D34-36 were sent to all sites by mistake. These samples are requested to send back to:

Empa Joining technology and Corrosion
 Att: Markus Faller
 Ueberlandstrasse 129
 CH-8600 Dübendorf
 Switzerland

It is agreed that, based on the results, at one point exposure of cast zinc will be replaced by exposure of titanium zinc (C). For coil coated samples that were exposed in October 2020 (34G and 34H), it will be decided later whether the exposure will be for 3 or 4 years. New coil coated samples will not be exposed this year.

Tim mentioned that it is more difficult now for BRE to act as a sub-center for limestone. However, supply of stone samples can be secure for the next 10 years. Aurelie mentioned that LISA can act as a sub-center for limestone. Further discussion among Tim, Aurelie, and Johan is needed. It is suggested that parallel exposure of limestone from BRE and LISA must be done very soon. Preliminary decision is to start this parallel exposure in 2023. Stefan suggested both sheltered and unsheltered exposure of

limestone on carousel. At the end, exposure of LISA limestone samples will be done every 3rd year.

12. Samples to be removed and sent to sub-center, and samples to be remained on the rack (2020-2021)

Namurata presented as shown below.

On rack before exposure start 2020						At some sites						
#A24			#D24		#V24			#S24	#B24	#B27	1 year	
#A25			#D25		#V25	#G24	#H24	#S25	#B25	#B28	3 years	4 years
#A26			#D26		#V26	#G27	#H27	#S26	#B26	#B29	8 years	
On rack after exposure start 2020												
#A31	#A24		#D31	#D24	#C31	#V24	#G34	#H34		#S24	#B24	#B27
#A32	#A25		#D32	#D25	#C32	#V25	#G24	#H24		#S25	#B25	#B28
#A33	#A26		#D33	#D26	#C33	#V26	#G27	#H27		#S26	#B26	#B29
On rack after withdrawal 2021												
							#G34	#H34				#B27
												#B28
							#G27	#H27				#B29
On rack after exposure start 2021												
#A41	#A44	#A47	#B41	#B44	#B47		#G34	#H34				#B27
#A42	#A45	#A48	#B42	#B45	#B48							#B28
#A43	#A46	#A49	#B43	#B46	#B49		#G27	#H27				#B29

Samples to be sent back to sub-center after October 2021 are:

Samples	Sub-center
A24-A26 A31-A33 S24-S26	SVUOM Ltd. Att: Katerina Kreislova U Mestanského pivovaru 934 /4 CZ-17000 PRAHA 7 Czech Republic
B24-B26	CENIM – National Centre for Metallurgical Research Att: Daniel de la Fuente Avda Gregorio del Amo 8 28040 Madrid Spain
C31-C33 D31-D33 D24-D26 D34-D36 (not exposed)	Empa Joining technology and Corrosion Att: Markus Faller Ueberlandstrasse 129 CH-8600 Dübendorf Switzerland
V24-V26	Rise KIMAB AB Att: Johan Tidblad P. O. Box 7047 SE – 16407 Stockholm Sweden
M24-26	Building Research Establishment Ltd., BRE Att: Tim Yates Bucknalls Lane Watford WD25 9XX United Kingdom
G24 H24	HAMK Sheet Metal Centre Häme University of Applied Sciences Att: Tiina Vuorio Visakaare 9 FI-13100 Hämeenlinna Finland
T31 O31 P31	Université Paris-Est Créteil Laboratoire Interuniversitaire des Systèmes Atmosphériques Att: Aurélie Verney-Carron 61 Avenue du Général de Gaulle F-94010 Creteil France

13. Discussion on work plan 2022-2023

Johan summarized the work plan for 2022-2023 as stated above. Monitoring and assessment of the impact of corrosion on the environment and of soiling effects on materials and their 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)

15:15-16:30 Update of Mapping Manual Ch 4 to include soiling**14. Summary of aesthetic thresholds from literature**

Johan presented literature review on dose-response function (DRF) of non-transparent materials. The suggestion is to recommend 30% loss in reflectance in the mapping manual with explanatory text citing references. Tiina commented that Table 5 on slide #9 in Johan presentation only showed acceptable levels of soiling to light-colored stone buildings. Tiina also mentioned that there is no correlation between PM10 and reflectance, but there is a correlation between PM10 and gloss for coil coated samples. Tim also suggested that this may depend on particles causing soiling as well. Terje commented that there is a difference between effect on soiling and effect on perception. Johan raised two open questions in his presentation. Ruth mentioned that, in many cases, soiling itself may protect the surface underneath, while cleaning process may have a negative effect on materials by increasing water permeability.

15. Discussion on the draft of updated Mapping Manual Ch 4 to include soiling

Namurata showed the draft of updated Mapping Manual Ch 4 to include soiling with a revision by Aurelie and comments from Johan and Terje. Johan suggested to add the same information in Table 4.1 for soiling. Aurelie informed that we do not have such kind of data yet. It was agreed that Namurata will send the current draft to Aurelie for further revision and Aurelie will further forward it to Terje.

Since there was time left on this session, **27l. Development of web page** was moved to discussed here.

Namurata presented the new web page for ICP Materials Program (<https://www.ri.se/en/icp-materials>). All agreed that the link to all e-mail address is not needed. Katerina suggested to add e-mail address for the Task Force. All agreed to have reports publications from the newest to oldest. Katerina recommended to categorize the report according to content, e.g., Environmental Data, Trend Exposure, UNESCO call for data. For active organization, all will send the current organization name and webpage to Namurata. For supporting organizations, all will send more information to Namurata.

Thursday May 6

9:00-10:30 Update of dose-response functions

16. Limestone

Tim presented current DRF from Economic Report. Rh60 may hide the effect of SO₂ and HNO₃. Tim informed that the components of the current DRF is fundamentally correct, but still suggested to revisit the data. There should be a clear separation between high and low pollution scenario. Johan asked if Terje would be interested in this work and Terje said yes. All agreed that the DRF of limestone should be revised.

17. Carbon steel

Katerina presented results according to ISO 9223 and MULTI-ASSESS project. There are irregular corrosion rate data when considering each test site. Cl⁻ deposition obtained from wet candle and dry gauze methods was presented and certain variation could be noticed. It was seen that $S_{d,c} = 2.4 S_{d,p}$ only when Cl⁻ deposition is higher than 10 mmd. It was concluded by Katerina that revision of DRF for carbon steel for mapping manual still needs more data, particularly Cl⁻ deposition.

18. Weathering steel

Daniel presented the results of characterization of corrosion product formed on exposed weathering steel samples. Common DRF for short-term data for CS and WS is suggested. 4- and 8- year exposure of CS and WS is highly recommended. 1-year data can be used for current DRF, while data for 4- and 8- year will be used to update the DRF later.

19. Zinc

Markus presented that the current DRF is ok for zinc. However, new data set of 4-year exposure is needed for a revision of DRF. HNO₃ showed no contribution to corrosion of zinc, therefore recommendation section on effect of HNO₃ will be added to the mapping manual and refer to technical report that will be written by Markus.

20. Aluminium

Johan presented results of aluminium. PM deposition tends to show effect on maximum pit depth. Katerina also agreed that uniform corrosion is not as critical as pitting corrosion for aluminium. Evaluation of both mass loss and pits for 4-year samples is recommended.

10:45-12:00 Update of dose-response functions (contd.) And UNESCO Cultural heritage sites

21. Copper

Namurata presented 1-year data of copper, where O₃ does not seem to show any effect. Johan asked if we should include O₃ in DRF of copper. It was suggested that either new DRF should be created for copper or verify that O₃ is still play a role in the current DRF. Terje suggested to consider threshold value of SO₂ where O₃ is still significant.

22. Correlation of corrosion obtained from DRF and Norwegian field exposure, and with IVL particle and chloride deposition for all years and stations

Terje presented results for test sites in Norway with variation from year to year. Simpler DRF with simple liners addition of Cl⁻ deposition from IVL passive sampler. Johan informed that according to Swedish work, Cl⁻ deposition obtained from IVL passive samplers was much lower compared to those obtained from wet candle method.

23. Referencing documents and reporting requirements

a. Approval of ICP Materials Report 89: Call for data “Inventory and condition of materials at UNESCO world heritage sites”. Part IV. Relative importance of individual pollutants and the effect of their reduction on the cost of pollution

Teresa presented Report 89.

13:30-15:00 UNESCO Cultural heritage sites (Contd.) and General session 2(2)

b. Report on application of models with increased resolution (1 km x 1 km) at selected UNESCO sites (2021)

Teresa presented Report 90.

i. Discussion of results from application of models with increased resolution, Italian sites.

Johan suggested to add recommendation of days between cleaning (50 x 50 km) in the mapping manual. Teresa will send excel file for calculation to Aurelie, Terje and Johan.

ii. Decision on included UNESCO sites

To increase resolution, data at local scale of 4 x 4 km or 1 x 1 km is needed. Amount of rain at that scale can vary significantly. Countries participating in UNESCO sites are Croatia, Germany, Italy, Norway, Sweden and Switzerland. Representatives from Croatia and Germany could not participate in this session. Terje mentioned that more monuments in Norway can be added and that pH is quite difficult to obtained for high resolution scale. However, it is possible to add the data close to the monuments in Norway. Terje will check with his colleagues on data of limestone recession. Johan will find out about data for Sweden. Markus mentioned that all parameters are measured in Switzerland. Johan mentioned that two important questions are (1) which data can be provided? and (2) when can it be provided? Teresa mentioned that resolution of 1 x 1 km is sufficient, but 100 x 100 m is preferred.

iii. Time schedule for reporting

Reports should be finalized in time for the meeting of EMEP/WGE in September.

c. Proposal work plan 2022-2023

Johan summarized the work plan for 2022-2023 as stated above. 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 Call for Data –Part VI: Study on the relationship between the environment 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)

24. Summary of decisions and time schedule

a. Exposure for trend analysis: Reporting 2021

Tiina showed the website for sun radiation. Tiina will send information directly to Terje and Terje will check if EMEP measure the same data. John asked if we would like to have measured data (taken into account cloud effect) or modelling data. Johan said that we would like to have the measured data.

b. Exposure for trend analysis: Exposure programme 2020-2025

Daniel discussed sample labeling of CS and WS as stated in session 11. Johan will discuss with Tim on how to label stone samples.

c. Update of mapping manual Ch4 to include soiling

Namurata will send the draft to Aurelie for further revision and Markus with all the text for DRF of zinc.

d. Update of dose-response function

Cl⁻ deposition with wet candle method is recommended as optional parameter to update DRF.

e. UNESCO Cultural heritage sites

Report 90 must be submitted in the end of September. Comments on the report must be sent to Teresa before the end of May.

25. Gothenburg Protocol Review and contribution to joint report

Namurata presented the draft of the factsheet. Terje suggested to add the text that most updated data also show similar trend and refer to ICP Materials website for more data. Namurata will revise the factsheet according to current comments and send again to everyone. The factsheet must be submitted before the end of July.

26. Decision on 2022-2023 work plan

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

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 Call for Data –Part VI: Study on the relationship between the environment 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)

27. Dissemination of results**j. Scientific publications**

Daniel have submitted extended abstract to ECC with the results of corrosion data and corrosion product characterization of WS in comparison to CS. It will be presented in July 2021 with possibility to be published. Draft will be ready in the end of 2021.

Terje presented 2 recent published papers.

k. Conferences

Daniel will participate in ICC Congress and Namurata may participate in EUROCORR. Tiina mentioned that she presented results from ICP Materials Program and she has got a lot of contact from industries. It is suggested we should arrange ICP Materials webinar for public audiences. Johan mentioned RISE webinar on corrosion.

l. Development of web page

This session was moved to the afternoon of May 5.

28. Any other business

Johan informed about the exposure site catalogue produced together with Tomas Prosek.