CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

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

Minutes of the 29th Meeting of the Programme Task Force

April 17-19, 2013, Restaurant Veranda, Bern, Switzerland
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The twenty-ninth meeting of the Programme Task Force of the International Co-operative Programme on the Effects on Materials including Historic and Cultural Monuments was held in Bern, Switzerland, on April 17-19, 2013. The meeting was organized by the Laboratory for Joining Technologies and Corrosion of the Swiss Federal Laboratories for Materials Science and Technology (Empa).

The meeting was attended by representatives from the following Parties to the Convention on Long-Range Transboundary Air Pollution: Czech Republic, France, Germany, Greece, Italy, Norway, Poland, Spain, Sweden and Switzerland.

1. Opening of the meeting

Johan Tidblad introduced the meeting and thanked the hosts for their hospitality. *Markus Faller* took over and firstly discussed the venue and the host city, followed by practical arrangements for the meeting including the excursion planned for 19th April 2013. All delegates then introduced themselves for the meeting.

2. Information from the local organizers

Beat Achermann, of the Swiss Federal Office for the Environment (FOEN) gave a welcome address and presentation which gave details of the Gothenburg protocol and its bearing on the ICP materials group including: Critical levels of particulate matter (PM); Critical levels of ammonia; Acceptable levels of pollutants in order to protect materials; Addressing black carbon (BC) as part of PM and interactions with climate change.

Examples of acid deposition as well as corrosion maps were shown in the presentation. A map of copper stock at risk was also shown, displaying a significant decrease of total amount corroded of 204t to 105t from 1990 to 2000.

3. Approval of the Draft Agenda

Johan Tidblad presented the draft agenda. *Stefan Brüggerhoff* commented that he would only be present for the first day. The draft agenda was approved.

4. Introduction

All participants had introduced themselves previously, and information about timings throughout the day was given by *Markus Faller*.

5. Discussion of the 2012 work plan

a) *Johan Tidblad* introduced ICP Materials Report 69: Technical manual for the trend exposure program 2011-2012.

It was commented that reporting here was done at different ambition levels depending on site. The report is available online for all to see and download. It was commented that the report should be a living document, continually updated as required.

All comments regarding update of Report 69 should be sent to *Johan Tidblad*.

Furthermore, all contacts are on the ICP materials website and should be updated as required, with relevant information being sent to *Johan Tidblad*.

Discussion was had on whether Report 69 should be translated into other languages, perhaps Russian, and these versions made available on website also – to be decided.

Comment was made that some of the procedures described in Report 69 are not followed. One problem could be transfer of information to the technician performing the withdrawal. To ensure correct instructions it was decided to develop one-page guidance(s) for technicians, with diagrams to make it easier to follow. All sub centres are requested to develop their own document and send to *Johan Tidblad* by end of May, circulation end of June 2013.

Passive samplers for particulate matter are seemingly too complicated to install and change. A new design has been tested at the Bottrop test site and will be used in the next trend exposure.

b) *Stefan Doytchinov* presented ICP Materials Report No 67 Pilot study on inventory and condition of stock of materials at risk at UNESCO cultural heritage sites. Part II Determination of stock of materials at risk for individual monuments.

The environmental data used in the estimations was discussed. It was concluded that data from sites as close as possible to the actual monuments should be used, where available. This is not necessarily data from the ICP Materials test site. For example, *Tiziana Lombardo* can provide better data to *Stefan Doytchinov* for more accurate analysis of the Paris location.

The accuracy and precision of estimated corrosion data was discussed and it was decided to include a discussion of this in the reports. More than one decimal point is not motivated. Also, the possibility of giving an interval of corrosion attack rather than a single value should be considered, which is related to the next point.

The possibility of modelling and monitoring of the specific environment at different positions around the site (microclimate) was discussed. This could be a topic for next year's report (2014), se below.

c) *Andrew Gordon* presented Report 71: The effect of black carbon on soiling of materials
There were no suggestions for changes to this report.

6. Info from Working Group on Effects (WGE) and common work plan items 2013

The presentation by Beat Achermann (point 2 above) served as a good introduction to this point emphasising the recent developments of the revision of the Gothenburg protocol and that effects on materials is now mentioned.

a) Report on the further implementation of Guidelines on Reporting of Monitoring and Modelling of Air Pollution Effects

Johan Tidblad commented that the indicator materials described in the guidelines are those included in the trend exposure, which will be discussed in more detail in connection with the current trend exposure below.

b) Final version of the report on impact analysis by the WGE.

Final version of the report is now available on the WGE homepage. The report gives a good overview of recent policy relevant information for the revision of the Gothenburg protocol. *Johan Tidblad* presented an overview of the report.

c) Report on ideas and actions to enhance the involvement of EECCA/SEE countries in Eastern Europe, the Caucasus and Central Asia and on cooperation with activities outside the air convention.

There was no participation of EECCA countries at the meeting. Therefore, different ways to increase participation was discussed. Reimbursement of costs for participation in meetings is necessary, covering the actual costs. The country of the meeting could play a role. ISO meetings are known to vary between China and Europe which works well in encouraging Chinese and eastern Asia participation. Furthermore, it is necessary to send invitations early to facilitate visa applications.

Alternative ways of identifying national focal points for effects on materials was discussed. Ukraine was currently the most promising country where *Lech Kwiatkowski* has some contacts. Otherwise, *Daniel de la Fuente* has a list of contact persons for the International Corrosion Council (ICC). All contacts for potential new countries should be sent to *Johan Tidblad*.

d) Report on biodiversity and ecosystems services

At the recent ICP Modelling and Mapping meeting in Copenhagen, *Harry Harmens* held a presentation of this year's report on biodiversity and ecosystems services. *Johan Tidblad* repeated the presentation and gave and overview of the report. ICP Materials is not participating in this work. The report is not yet finalised and will be available to download soon.

e) Review of the ICP's

Johan Tidblad gave a summary of the on-going review of the ICPs, which was decided by the EB in December 2012 is expected by Dec 2013. A review group has been appointed and will give their recommendation to the EB by December 2013. The review group has asked the ICPs to answer some questions, including the key science needs, possibilities to meet these needs and options for organisational changes. The meeting focused the discussion on future science needs. The topics discussed included

- Increase the geographical coverage
- Continue the work of soiling, especially related to PM/BC
- Include additional materials sensitive to other pollutants, stainless steels and polymeric materials was discussed specifically
- Effects of climate change, for example combined effect of air pollution and frost damage of stone materials
- Possibilities to expose "precorroded" materials
- Continue work on UNESCO cultural heritage sites as user-friendly indicators and for cost assessments

7. Discussion of 2013 work plan

a) Updated report (Report 72) on corrosion and soiling results from the 2011-2012 trend exposure: Sub-centres reported on results from individual materials.

- Environmental data (*Terje Grøntoft*) – a summary was given of the results collected so far, followed by discussion of any missing data. Each site promised to send missing data as soon as possible. For Sofia (site 54) no data is available. Milan had problems with collecting passive samples. Ammonia was only collected at 3 sites (optional parameter). Organic acids were discussed. The measured concentration values are very low and these parameters will not be mandatory in the future.

  Some differences were seen in SO_2 values between IVL samplers and local sampling – Martin Ferm should be consulted. NO_2, SO_2, O_3, HNO_3, Rain, pH, temp, RH and PM parameters were all discussed. *Terje Grøntoft* will send out reminders to all sites with requests for missing data.

- Carbon Steel (*Katarina Kreislova*) - Preliminary results were presented. SO_2 seem to be increasing with the use of low grade domestic coal, thus an increase in corrosion has been seen in the Czech Republic. The ISO 9223 equation did not fit satisfactorily with the data.

- Weathering steel (*Daniel de la Fuente*) - 1 out of the 3 samples has been saved, with the intention for further analysis of corrosion products if this is acceptable to the group. Everyone agreed this was acceptable idea even though it was against standard analysis procedure. Standard deviation of remaining two samples was only approx. 5%.

- Zinc (*Markus Faller*) – Decreasing corrosion trends was seen. Test site 40 Paris has moved since 2008 so the results cannot be compared from this year. Corrosion products on the withdrawn zinc samples were analysed by extracting

the water-soluble anions. The analysis by capillary electrophoresis showed again that after chloride, at some test sites, the main component is sulphate. Similar to the last trend expose 2008/09 there was also some organic acids like formate and acetate found. This is a hint that these agents are also involved in the corrosion process. Further investigations are necessary.

- Limestone (*Tim Yates* (not present)) – The overall trend seems to be that rates of surface recession (and so of weathering) declined rapidly between 1987 and 1997 and since then the changes have been much smaller. Two other effects seem to be apparent – the first is that the range has become less – the rate at most sites is similar (9 µm $year^{-1}$) and the second is that the change at the rural site has been less. Neither finding is too surprising as they reflect the reduction in urban sulphur dioxide.

- Copper (*Andrew Gordon*) - 1 out of the 3 samples has been saved, with the intention for further analysis; this was agreed by all as with the weathering steel samples. Weight change (during exposure) of samples is not straight forward to explain as many factors affect it – rain, wind etc. Generally corrosion rate was seen to have decreased compared with previous results except for site 3 Kopisty and site 10 Bottrop.

- Modern glass (*Aurélie Verny-Carron*) - Some samples were not measurable due to damage during exposure or handling and shipping. Mean mass of deposition was found to be similar between 2005 and 2012. No clear trends in haze measurements were found. Results are consistent, but must be correlated to environmental data. Mass and haze is seen to not be a linear relationship – a saturation point is reached.

  A question was asked why site 50 Katowice soiling results are so high? It was noted that there was some animal activity nearby which could have contributed. Rural sites generally have low soiling – no clear explanation was found for the deviation.

  Sites 15 Milan and 16 Venice has moved location so the results cannot be compared to previous exposures.

Report 72 – All sub centres to send data to KIMAB in excel format, deadline 31st May 2013. Include comments on any special data. Report deadline is September 2013. No analysis details are required, and environmental data is not required in this report.

Johan Tidblad commented on the aluminium exposure, should Al samples be withdrawn as planned after 2 years? *Johan Tidblad* will remind all centres at withdrawal time. Al samples are to be visually assessed before decision taken whether to withdraw in 2013 or not. Exposure could be changed to a 4 year exposure instead. All sites with easy access to exposure racks shall check Al samples and report back to *Johan Tidblad* as soon as possible.

b) Updated report (Report No 73) on the pilot study on inventory and condition of stock of materials at risk at United Nations Educational, Scientific and Cultural Organization (UNESCO) cultural heritage sites (*Stefan Doytchinov*).

Report 73 is due to be completed by September 2013 and a first draft will be circulated to Task Force members by 30th June 2013. It will include economic evaluation of air pollution effects on the UNESCO monuments. The methodology of analysis was presented. All sites were found to be below the 2020 target corrosion rate except Berlin. A calculation of the direct cost of maintenance per material was presented. It was noted that less frequent maintenance may lead to more complicated maintenance overall.

It should be stated in the report that a complete cost benefit analysis (CBA) must also include other effects, such as health effects and that this report only aims at estimating benefits of reducing air pollution.

The pilot study carried out in Prague was discussed, in particular the effect of microclimate. This location was partly chosen due to its long record of environmental monitoring data, ca 250 years for some parameters, environmental data was collected at various points around the site for 2 years previous to the analysis. Some reconstruction of the site has been completed therefore some new materials were available to study also. Colour changes of newly painted facades were studied.

c) Report (Report No 74) on exposure of modern glass 2008-2012 and soiling dose-response functions (*Tiziana Lombardo*);

The final report is due September 2013 for the WGE meeting in Geneva. Eleven sites were assessed for the report. Paris and Milan have changed location of their respective sites during this period, which should be taken into account when comparing trend data.

It is essential with a complete data set of especially NO_2, SO_2, and PM for the entire period and for all sites. *Tiziana Lombardo* will send a reminder of this to all site managers ASAP with a reporting deadline 31st May 2013 for the pollution data.

The question was raised if there is an accepted haze tolerance for glass? 1% is generally used as the threshold for visual inspection, and is used by industry in manufacture. Cleaning frequencies can vary between locations.

Variation of haze has been detected between each year. Question was raised if position of samples in exposure box could have an effect on this? This effect has been tested and conditions in the exposure box were found to be homogeneous. Variation of haze shall to be discussed in the report, along with thresholds for haze.

8. Discussion of 2014-2015 Work plan

Suggestions for work plan items are (see discussion of individual points below):

2014

- Trends in pollution, corrosion and soiling 1987-2012
- Environmental data report October 2012 to September 2012
- Updated UNESCO report

2015

- Technical manual for the 2014 exposure programme for trend analysis
- Updated report on soiling dose-response functions
- Call for data: UNESCO sites

a) Updated reports on trends in pollution, corrosion and soiling (*Johan Tidblad*); Following the cycle of reporting adapted to trend exposures each third year the report for 2014 should be focussed on long-term trends taking into account the most recent trend exposure and the report for 2015 should be focussed on the technical procedures for the 2014 trend exposure.

b) Updated reports on the materials degradation at UNESCO sites (*Stefan Doytchinov*) Several options for possible continuation of activities at UNESCO sites were discussed. It was agreed that to continue this activity is very important as UNESCO sites are well known and could serve as user-friendly indicators of materials damage.

The first option, suggested as an activity for 2014, is to assess the specific environment at different positions around the site (microclimate). This is important in order to quantify intervals of corrosion attack as opposed to single values based on an average pollution situation. *Terje Grøntoft* suggested study could be extended to monuments of other materials than limestone, Eiffel tower as an example. *Stefan Brüggerhoff* added that a new program in Germany has begun to gather data for calculation and modelling, which includes open data, and that next year a report will be available for all.

The second option, suggested by *Beat Achermann* was to have a "call for data" to Parties of the Convention, similar to what is done by ICP Modelling and Mapping. This is to be discussed at the next WGE meeting for approval by WGE and ultimately be EB in December. The call should be issued in 2015.

Johan Tidblad suggested more cooperation with UNESCO, *Stefan Doytchinov* agreed to look into this and provide contacts. *Terje Grøntoft* suggested choosing sites with high pollution. *Johan Tidblad* suggested including costs of soiling not just corrosion in the call for data.

d) 30th meeting of the Programme Task Force

The next meeting is planned to be held in Stockholm, Sweden, April 23-25th 2014 (subject to confirmation).

9. Medium term work plan (-2017)

The next exposure for trend analysis will start in 2014 and this will be an opportunity to include new materials. Discussed materials included copper, polymers, stainless steels, aluminium and aluminium alloys, and coated materials.

In order to assess the exposure of new materials space limitations on the racks need to be quantified. Therefore all sites to report back ASAP on space as well as the possibility to extend racks. Johan Tidblad will send a reminder.

The proposed call for data in 2015 will affect the work plan for 2016-17.

10. Dissemination of results

a) Scientific publications

The soiling DRF's is planned to be published as a scientific paper (*Tiziana Lombardo*). It was recommended to distribute a draft to the Task Force members before publication.

b) Brochures

WGE have brochures and these are popular. It was agreed that it would be good to have an easy to read ICP materials brochure. A passible subject could be the studies on UNESCO sites and this brochure could be sent together with the call for data. Johan Tidblad will make a proposal together with the sub-centre for stock at risk in Italy.

c) Workshops and other ways of involving scientists outside ICP Materials

Stefan Doytchinov discussed his involvement in cultural heritage exposition in Torino, Italy during the last 2 years. ICP materials data was displayed and well received. *Stefan Doytchinov* was asked to be more involved in this exposition in the future. ENEA will publish ICP materials data on their website also.

Johan Tidblad discussed his Eurocorr conference involvement, which could be good way to share ICP materials work.

d) Development of web page

Generally it was agreed that the website must be updated. Suggestions included a diagram for the Multiassess program, and including relevant Keywords to improve searchability, such as atmospheric corrosion, DRF's, effects of pollution etc. It was agreed, however, to first analyse the statistics for the ICP materials website usage etc. to establish the most effective ways to modernise the site. Evaluation against other ICP websites could be done. However, it was agreed that it would be best to wait on any organisational changes decision from EB before any major website changes. Minor suggestions for improvement should be sent to *Johan Tidblad*.

11. Financing of the programme

Each member of the group gave a summary of the current funding situation of their country:

- Sweden – 1 year contract, through Swedish Environmental Protection Agency
- Italy – 1 year contract. Currently 4 stations, with good long term collaboration between hosts and regional agencies.
- Norway – like Sweden and Italy with a 1 year contract.

- France – support comes from the French agency for new energy, which recently had a major restructure. 2 years of financing is currently in place.
- Germany – 3 year contract newly agreed. However, this funding only covers approx. 50% of costs. Most costs come from travel and passive sampling.
- Greece – unclear on financing at the moment. Waiting for further information.
- Poland – funding has been reduced. Future uncertain currently, but efforts will be made.
- Czech Republic – 1 year contract. However, this financing only covers only part of costs.
- Switzerland – 4 year contract recently agreed. ICP meetings are financed separately.

It was commented that the number of participating sites appears to be diminishing, and concern was raised over the where this may lead. It was highlighted that the group can fund calls to all countries not just those within the programme. A suggestion of an offer to emerging countries such as those in Asia, South America may be beneficial. All are encouraged to gather contacts for possible new participant countries.

12. Any other business

Stefan Doytchinov announced his retirement – as of 1st May 2013. His replacement will be Pasquale Spezzano. *Stefan* commented that he shall continue to contribute as much as possible depending on funds and time. *Stefan's* email address shall continue to function.

Tiziana Lombardo announced a change of job as of 1st July 2013 – *Aurélie Verny-Carron* shall take over *Tiziana*'s duties. *Tiziana* shall work on ICP materials reports until the end of 2013. New contacts details for *Tiziana* will be sent out soon.