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RECENT RESULTS AND UPDATING OF SCIENTIFIC AND TECHNICAL KNOWLEDGE

**ASSESSMENT OF STOCK OF MATERIALS AT RISK,
INCLUDING CULTURAL HERITAGE**

Report by the Programme Centre of the International Cooperative Programme on Effects of
Air Pollution on Materials, including Historic and Cultural Monuments

I. INTRODUCTION

1. The main results on the assessment of stock of material at risk are presented here in accordance with item 3.2 (a) of the 2008 workplan for the implementation of the Convention (ECE/EB.AIR/96/Add.2) adopted by the Executive Body at its twenty-sixth session in December 2008.
2. Dose-response functions for materials were available in 2001 for the situation dominated by sulphur dioxide, developed by the International Cooperative Programme on the Effects of Air

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Pollution on Materials, including Historic and Cultural Monuments (ICP Materials). They are currently available for the multi-pollutant situation as well. These functions involve both pollution and climate parameters and have a high degree of confidence. Effects on materials have not yet been included in integrated assessment modelling and or in the 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol). The reason is lack of data on stock at risk. Currently, no stock-at-risk estimates of any heritage materials are available at a continental level.

3. This year, a full report (number 61) of ICP Materials “Stock at risk assessments of materials including cultural heritage”, was issued. It describes and summarizes stock-at-risk studies performed so far.

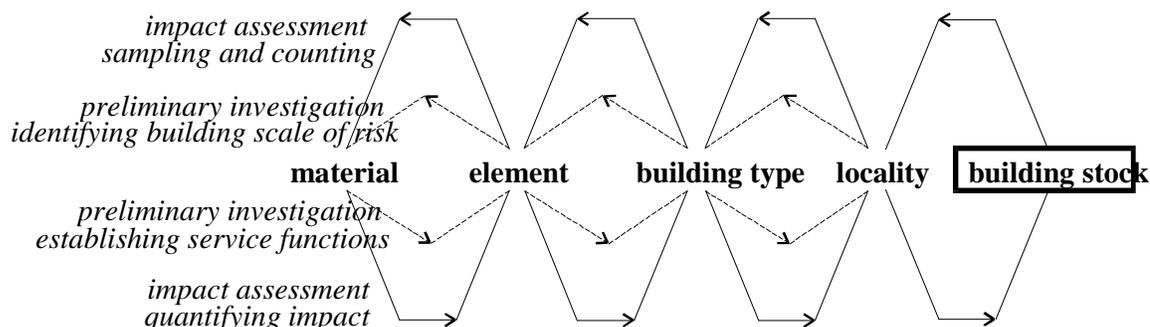
4. This report presents an overview of the methodologies available for stock-at-risk estimates of technical materials and cultural heritage. It also indicates the most important sources of information for collecting data.

II. OVERVIEW

5. Methods for assessing stock at risk are preferably categorized according to the geographical scale, such as individual buildings, city districts, entire cities, countries and the continental level. Without careful planning, a large amount of information could be collected that finally proves to be useless. The appropriateness of the data needs to be related to the scale of the survey and the desired endpoint. The spatial resolution and detail for each data set needs to be comparable. Some form of sensitivity analysis should be used to determine the weakest link in the chain. For example, there it is not useful having exact locations of every building without records on the origin of stones used in those buildings.

6. There are two approaches, top-down and bottom-up, when considering deterioration and weathering (see figure below). The former emphasized primarily the building stock and then checking details. The latter starts with the materials or components and then determines how the stock will be affected.

Figure. Illustration of the top-down and bottom-up approaches in collecting data



III. DIRECT MEASUREMENTS

7. A direct measurement includes work in the field measuring surfaces occupied by each type of material, once its nature is determined (e.g. stone, mortar/rendering/plaster, painting, brick, metal, glass). This very simple method permits an evaluation without any theoretical modelling or generalization, by direct observation, counting and measurement.

8. The method is most suitable when assessing single objects or buildings, such as Aldobrandini Villa in Frascati, Italy. It can also be used in a city district, such as the World Heritage site of United Nations Educational Scientific and Cultural Organization (UNESCO) in Paris, or even a country, e.g. Italy. Due to the large amount of human and other resources needed, the larger the scale of interest, the less practical this method becomes. However, this method is the basic foundation of any study of stock at risk. At least some of the buildings in a particular study need to be assessed by this method and then combined with the other methods described below.

IV. THE IDENTIKIT

9. Identikits are generic building types developed to represent the dominant styles of buildings found within a region. They provide estimates of the average proportion of different materials used in their construction. They are developed from direct measurements of a collection of similar objects or buildings, and are used to generalize data to other objects of the same category when there are no direct measurements available.

10. Examples of possible identikits could be “a typical semi-detached house in the United Kingdom” or “a typical Gothic cathedral in Europe”. An identikit is not only a label in itself, but a label accompanied with a detailed description of the exposed materials and their respective surface area. For example, it is possible to create a map of Gothic cathedrals in Europe, but without this detailed description it is only a category, not an identikit.

V. BUILDING REGISTERS

11. Often it is impractical to only rely on direct measurements or self-created identikits when assessing stock at risk at a larger scale. Building registers, when available, provide a means to categorize buildings. They can help in deciding which identikits to use and in providing statistical samplings when selecting buildings for the direct measurement method.

12. The data available from building registers varies. Specific methods should take into account the available data. An assessment of stock at risk for a single city is preferably assessed by combining building registers with the identikit approach and inspection of individual buildings.

VI. DATA FROM GEOGRAPHICAL INFORMATION SYSTEMS

13. Geographical information systems may include large-scale maps of buildings, data from remote sensing (satellites), and photogrammetric data. For example, land-cover information does not provide data on the number or type of buildings. Satellite data can be used to indicate the spatial distribution of the building stock; however, an estimate of total stock in terms of buildings themselves is required. This can either be calculated bottom-up, attempting to count individual buildings from maps, or top-down, with census data.

VII. CENSUS DATA

14. At the European scale, the use of census data is probably the only practical choice. Estimates of residential floor space per capita were combined with the spatial distribution of buildings, based on published population density data, when the benefits of implementing the 1994 Oslo Protocol on Further Reduction of Sulphur Emissions (1994 Sulphur Protocol) were estimated. This was combined with identikits for Eastern and Western Europe based on direct measurements from Prague and Stockholm.

VIII. SPECIFIC METHODS FOR CULTURAL HERITAGE

15. There is a potential of using published information from sources such as good quality tourist guides, as they report more or less detailed information. The Italian Touring Club Guide provided information on the objects with historic and cultural value for one such study.

16. The European cultural heritage is one of the richest in the world. The World Heritage List of UNESCO could be used as a source for important sites at the European scale, as 387 of the 745 sites listed are located in Europe.

IX. SOURCES OF INFORMATION

17. In addition to individual studies reported in the literature two main sources need to be considered when collating information on performed stock at risk studies. These are (a) the workshop on economic evaluation of air pollution abatement and damage to buildings held in 1996 in Stockholm and (b) the project CULT-STRAT of the European Union.

18. The proceedings of the workshop included descriptions of the study on Stockholm, Sarpsborg (Norway) and Prague. It was a detailed description of the identikit approach and studies performed for example in the Czech Republic, Italy and the United Kingdom.

19. The CULT-STRAT project focused on the assessment of cultural heritage. It included many studies in France, Italy, Norway, Spain and the United Kingdom, and also at the European scale.

X. CONCLUSIONS

20. This report summarized available methodologies for assessing stock of materials at risk including cultural heritage at different geographical scales, ranging from individual buildings to the regional level. It is necessary to combine several of these methods to provide reliable assessment of stock at risk at the European scale.
