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English version

Guide to the implementation of cool surfaces for buildings' envelope to mitigate the Urban Heat Island effects

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European foreword

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Introduction

By 2050, according to UN projections, the world population is expected to reach ten billion people. Today half of the population is living in cities and projections show more than 80 % by 2050. Cities are where 80 % of global GDP is produced, but they are also where 70 % of the energy is consumed and 75 % of waste and Greenhouse Gas (GHG) emitted.

Abating GHG emissions and increasing energy efficiency are at the heart of our European strategy and regulatory framework, with a focus on cities and built areas that offer a high potential for improvement and for meeting the EU Green Deal objectives. Urban Heat Island effect is one important topic both to mitigate climate change and to adapt. Minimizing these Urban Overheating effects contributes to reducing energy consumption by lowering energy demand for cooling and ventilation during hot periods, and thus the related GHG emissions¹, as well as to bringing better comfort to citizens.

This document presents guidelines about why, when, and how to consider mitigation of Urban Heat Island effects with cool roofs and cool materials, as well as reference information about characteristic parameters and how to select appropriate materials.

Cool materials are especially of high importance for new buildings and constructions but also for retrofitting of existing built infrastructures. A cool material is characterised by higher solar reflectance in comparison to conventional roof materials displaying the same colour and high infrared emittance values. Cool roofing products can be applied to all types of roofs including those of residential buildings, apartment blocks, industrial and commercial buildings, hospitals, and offices.

The benefits are direct and numerous, such as reducing the cooling energy consumption and even leading to avoiding the installation of air conditioning, by keeping temperature indexes lower around Renewable Energy Systems (i.e. Photovoltaic) and thus maintaining higher efficiency and longer life of these pieces of equipment, by extending the life of the roofing materials, and of course by keeping the surrounding temperature lower, which impacts the quality of life and health.

This document will also contribute to setting common elements of language (terms and definitions) and raising awareness among decision-makers, urban planners and constructors, both private and public, and among investment institutions and investors, about the benefit of cool materials, as well as guiding them towards the selection of appropriate solutions against Urban Heat Island effect with immediate and long-term multi-benefits.

Whilst the guide focuses on cool materials for roofs it is also relevant to other parts of the building envelope, other construction and built infrastructures, including roads and pavements, by aligning terms and definitions as well as considerations about characteristics of cool materials.

¹ This document is not intended to address consideration about carbon footprint of materials.

1 Scope

The document provides the terminology relating to cool materials and a guide to the implementation of cool surfaces for building envelopes to mitigate the urban overheating effects. It concentrates on the application to roofs.

The document will focus on urban areas for local authorities and building/construction owners.

The users of CWA 17890:2022 will be local authorities, urban planners for cities including construction, infrastructures and landscape architects.

In addition, the terminology and characteristics of cool materials will serve as a reference for other applications where the use of cool materials will have a significant contribution to adaptation to climate change as well as quality of life, such as for roads and pavements.

Whilst reflective surfaces can be very beneficial, they are not appropriate or effective in all climates for all buildings or building constructions and some guidance is provided.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 490, *Concrete roofing tiles and fittings for roof covering and wall cladding*

EN 492, *Fibre cement slates and their fittings for roofing*

EN 494, *Fibre-cement profiled sheets and fittings — Product specification and test methods*

EN 501, *Roofing products from metal sheet — Specification for fully supported roofing products of zinc sheet*

EN 502, *Roofing products from metal sheet — Specification for fully supported roofing products of stainless steel*

EN 504, *Roofing products from metal sheet — Specification for fully supported roofing products of copper sheet*

EN 505, *Roofing products from metal sheet — Specification for fully supported roofing products of steel sheet*

EN 506, *Roofing products of metal sheet — Specification for self-supporting products of copper or zinc sheet*

EN 507, *Roofing products from metal sheet — Specification for fully supported roofing products of aluminium sheet*

EN 508, *Roofing and cladding products of metal sheet — Specification for self-supporting products of steel, aluminium or stainless steel sheet*

EN 534, *Corrugated bitumen sheets — Product specification and test methods*

EN 544, *Bitumen shingles with mineral and/or synthetic reinforcements*

EN 1013, *Light transmitting single skin profiled plastic sheets for internal and external roofs, walls and ceilings — Requirements and test methods*

EN 14509, *Self-supporting double skin metal faced insulating panels — Factory made products — Specifications*

EN 12326-1, *Slate and stone for discontinuous roofing and external cladding*

EN 1304, *Clay roofing tiles and fittings*

EN 13956, *Flexible sheet for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics*

EN 13707, *Flexible sheets for waterproofing — Reinforced bitumen sheets for roof waterproofing — Definitions and characteristics*

EN 15976:2019, *Flexible sheets for waterproofing — Determination of emissivity*

EN 17190, *Flexible sheets for waterproofing — Solar Reflectance Index*

ISO 9346, *Hygrothermal performance of buildings and building materials — Physical quantities for mass transfer — Vocabulary*

ISO 9050, *Glass in building — Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors*

ASTM E903, *Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres*

ASTM D7897-18, *Standard Practice for Laboratory Soiling and Weathering of Roofing Materials to Simulate Effects of Natural Exposure on Solar Reflectance and Thermal Emittance*

ASTM E1980-11, *Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces*

ISO 14082, *Radiative Forcing Management— Guidance for the quantification and reporting of radiative forcing-based climate footprints and mitigation efforts*

ISO 6707-3:2017, *Buildings and civil engineering works — Vocabulary — Part 3: Sustainability terms*

ISO 16474-3:2021, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 16378:2013, *Space systems — Measurements of thermo-optical properties of thermal control materials*

ISO 22969:2019, *Peintures et vernis — Détermination du facteur de réflexion solaire*

ISO 9488:1999, *Solar energy — Vocabulary*

ISO 9229, *Thermal insulation — Vocabulary*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.