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BRITISH BOARD OF AGRÉMENT ASSESSMENT REPORT
Ref: M2/53621

**ASSESSMENT OF NOXITE MINERAL GRANULES
DEPOLLUTING PROPERTIES**

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On behalf of the British Board of Agrément

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Client: Icopal Ltd
Job No: M2/53621
Report by: Vanessa Adell
Work period: November 2013 – December 2013

1 Introduction

This assessment report M2/53621, prepared for Icopal Ltd., aims to evaluate the depolluting properties of Noxite⁽¹⁾ mineral granules, when used as a component of the Eco-Activ⁽²⁾ waterproofing system, with particular reference to the capture and decomposition of nitrogen oxides (NO_x) type atmospheric pollution. It also aims to review the potential credits towards the *BREEAM Code for Sustainable Homes* (CSH) and the *Leadership in Energy and Environmental Design* (LEED) rating system. It does not evaluate the waterproofing properties nor any other technical performance characteristics of the Eco-Activ waterproofing system.

(1) Noxite is a registered trade mark.

(2) Eco-Activ is a registered trade mark.

NO_x is a generic term for nitric oxide (NO) and nitrogen dioxide (NO₂), two major pollutants in the atmosphere and precursors of acid rain and photochemical smog, as well as ozone creation accumulation.

Noxite are titanium dioxide (TiO₂) mineral granules incorporated as a coating on the Eco-Activ roof waterproofing system. TiO₂ can act as a photocatalytic degradation agent, which degrades (oxidises) NO_x into nitrate salts (NO₃⁻), which are washed away in the form of harmless salts by rain water. Rain water can also act as a self-cleaning agent, regenerating the catalyser (TiO₂ particles).

The assessment was based on test reports provided by Icopal Ltd, incorporating the following:

- 1 UL Environmental Inc. *Environmental Claims Validation for Paradiene 30 FR Eco-Activ*
- 2 CSTB *Pass'Innovation 2009-016; Eco-Activ waterproofing system*
- 3 TNO *The effectiveness of Icopal waterproofing membranes to capture nitrogen oxides.*

2 Evaluation of depollution properties

2.1 UL Environmental Inc. *Environmental Claims Validation for Paradiene 30 FR Eco-Active*

UL Environmental Inc. carried out NO_x degradation tests to ISO 22197-1 : 2007 (after artificial ageing to standard EN 1297) to validate the air purification performance of photocatalytic materials. The tests were conducted on a sample of Paradiene 30 FR Eco-Activ Modified Bitumen Rolled Roofing. In addition, a desktop review of documentation was conducted and an on-site audit of the manufacturing process at Siplast Inc, in Arkadelphia, AR, USA.

The results showed that between 417 and 4143 g of NO_x per square metre of roof can be absorbed and degraded from the atmosphere.

The results were expressed on the basis of the 20 year life expectancy of a new roof as used by the USA National Roofing Contractors' Association, and took into account degradation in performance of the photocatalytic material over time.

Traceability of the test samples to the production line was not confirmed during this assessment.

This validation report was issued 14 June 2013 and is scheduled for a review in June 2014.

2.2 CSTB *Pass'Innovation 2009-016, Eco-Activ waterproofing system*

The depolluting performance was characterised by tests carried out in the *Centre National de la Recherche Scientifique* (CNRS) laboratory at Orleans (ICARE unit) on Eco-Activ membranes incorporating Noxite protection which were manufactured at the Siplast plant in Mondoubleau, France.

The tests were carried out under conditions representative of a polluted atmosphere in an urban environment, using a simulation chamber of 275 litres capacity. The product was exposed to a blend of nitrogen monoxide (about 220 ppb) and nitrogen dioxide (about 50 ppb) and subjected to solar radiation (simulated by UV lamp) for seven hours without air renewal, i.e. under static conditions.

Unaged Noxite granules displayed limited depolluting capacity, with an overall reduction in NO_x of 27% resulting in a reduction of 46% in NO and an increase of 58% in NO₂. After two months of natural ageing, the Noxite granules showed a depolluting capacity of approximately 90% in NO_x, a reduction of 100% in NO and of 17% in NO₂.

Again, traceability of the test samples to the production line was not confirmed during this assessment.

This Pass'Innovation report was issued on 2 October 2009 and had a validity of two years.

2.3 TNO *The effectiveness of Icopal waterproofing membranes to capture nitrogen oxides*

TNO conducted a series of tests to evaluate the effectiveness of Icopal waterproofing membranes containing trace elements of titanium oxide. Tests were conducted both under laboratory conditions and on real samples from a system in use at Schipol airport.

In the test results on the roofing samples at Schipol airport, the effective deposition velocity (i.e. the effectiveness of the roofing in removing nitrogen oxides) was calculated by measuring the amount of nitrate and nitrite within rainwater collected from drainage pipes (i.e. which has been in contact with the roof), and comparing it to the concentrations in rainwater which has not been in contact with the roof. The results showed an effective deposition velocity of 0.10 cm·s⁻¹.

In the laboratory test analysis the effective deposition velocity was determined using a bell glass sample, by calculating the difference between incoming and outgoing NO_x in a flux of air with predetermined concentrations of NO and NO₂. Tests in the laboratory showed a deposition velocity between 0.4 and 0.8 cm·s⁻¹.

Information on the samples tested was not provided, therefore traceability of the test samples to the production line could not be confirmed during this assessment.

This report was issued on 23 September 2010.

3 Contribution to sustainable buildings rating systems

3.1 BREEAM Code for Sustainable Homes (CSH)

The BRE Environment Assessment Method (BREEAM) CSH measures the sustainability of a home/building against nine design categories, rating the 'whole building (home)' as a complete package. The design categories are:

- Category 1: Energy and CO₂ emissions
- Category 2: Water
- Category 3: Materials
- Category 4: Waste
- Category 5: Surface water run-off
- Category 6: Pollution
- Category 7: Health and well being
- Category 8: Management
- Category 9: Ecology.

Each category includes a number of issues which have a potential impact on the environment. Under Category 6: *Pollution*, Subcategory: *Pol 2 NO_x Emissions*, constructions using roofing materials which can contribute to lower NO_x emissions are currently not receiving additional credits. However additional credits can be achieved under Category 3: *Materials*, Subcategory: *Mat 1 Environmental impact of materials*. This would require performing a full life cycle assessment, environmental profile, ecopoint scoring and green guide rating of the roofing membrane containing the product. At this stage, it is not possible to determine the exact credits as it is uncertain how Noxite mineral granules could affect the final ecopoint score and green guide rating of a roof containing the product.

3.2 Leadership in Energy and Environmental Design (LEED)

The Leadership in Energy and Environmental Design (LEED) is a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes and districts. It rates the performance of a building based on the following categories:

- Energy performance
- Water performance
- Indoor Environmental Quality (IEQ) performance
- Sustainable sites
- Materials and resources
- Innovation in design

The use of roofing materials which can contribute to lower NO_x emissions is not currently covered under any category per se. However it is possible that the LEED rating system allows for a building to gain up to five additional points when using the products under the 'Innovation and Design' category. However at this stage is not possible to predict how many additional points can be gained as this can only be assessed by a qualified LEED assessor on a case-by-case basis.

4 BBA Certification

Noxite mineral granules can be included as a component of a certificated waterproofing system which complies with the requirements specified by the BBA

A BBA Certificate for a roof waterproofing membrane containing Noxite could list the depolluting properties of the material in the *Environmental* section.

5 Conclusion

Test results show that Noxite granules have a significant depolluting capacity when added as a mineral finish to waterproofing membranes. A summary of findings is as follows:

- UL Environmental estimated that, over a 20 year period, between 417 g and 4143 g of Nitrogen Oxides per square metre of roof can be absorbed and degraded from the atmosphere.
- The Centre Scientifique et Technique du Batiment (CSTB) reported a depolluting level of approximately 90% in membranes two months after installation.
- TNO estimated an effective deposition rate of $0.08 \text{ cm}\cdot\text{s}^{-1}$ and $0.10 \text{ cm}\cdot\text{s}^{-1}$ as measured in laboratory tests and in-use conditions respectively.

Construction materials which contribute to lower NO_x emissions do not currently receive additional credits under the *Code for Sustainable Homes* 'Pollution' category (Pol 2 *NO_x Emissions*). However, additional credits could be achieved under the 'Materials' category (Mat 1 *Environmental impact of materials*). This would require undertaking a full life cycle assessment and environmental profile of the roofing membrane containing the product.

The LEED system might allow for a building to gain up to five additional points when using the products under the *Innovation* category.

A BBA Certificate for a waterproofing membrane or system containing Noxite mineral granules could include the depolluting properties of the material in the *Environmental* section.

This Assessment report did not evaluate the waterproofing properties nor any other technical performance characteristics of the Eco-Activ waterproofing system.

6 References

BS ISO 22197-1 : 2007 *Fine ceramics (advanced ceramics, advanced technical ceramics — Test method for air-purification performance of semiconducting photocatalytic materials*.

Environmental Claims Validation for Paradiene 30 FR Eco-Active Report 13CA02333, UL Environmental Inc, 14 June 2013.

Pass'Innovation 2009-016, Eco-Activ waterproofing system, CSTB, October 2009.

TNO-034-UT-2010-01679-RPT-ML The effectiveness of Icopal waterproofing membranes to capture nitrogen oxides, TNO, 23 September 2010.