

Sustainability GSE FabriNet HF-E B120 drainage mat
Addition ENBB-advice 015

*This version is an English translation of a Dutch advice.
Only the Dutch version of this advice applies.*

**Advieskamer
Stortbesluit**



Mr C.J. Meijler, president

Ir J.F. de Boer, secretary

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1 Summary

In 2009 GSE Lining Technology GmbH (hereafter: GSE) requested the former ExpertiseNetwerk BodemBescherming (ENBB) to investigate whether the GSE FabriNet HF-E B120 drainage mat is equal to the reference drainage layer according to the Disposal Standard and to estimate the possible lifetime.

On October, 22nd 2009 ENBB has given advice (ENBB-advice 015), in which they concluded that the corresponding drainage mat "is a equivalent alternative for the standard sand drainage layer". They concluded also that the drainage mat is sustainable. Due to insufficient test data of the non-woven material in the drainage mat, the ENBB could not determinate the sustainability with concrete figures.

In 2012 GSE requested to determine the sustainability of the non-woven material. On July, 30th TNO reported its results.

Based on the findings of TNO, Mr. Ir D. Boels – the former secretary of the ENBB – has implemented an adaptation of the original ENBB-advice. This adaptation is reflected in an not formally published ENBB-advice, version August, 15th 2013. However, since ENBB at the moment of this adaptation, did not exist anymore, the adaptation could not be formalised.

On December, 13th, GSE has requested the Advieskamer Stortbesluit to formalise the ENBB-advice.

Based on its findings, the Advieskamer Stortbesluit concludes as follows:

The Advieskamer Stortbesluit confirms the conclusion of the ENBB-advice 015 – version August, 15th 2013 stating that the FabriNet HF-E B120 drainage mat for the further on indicated technical lifetime is equal to the one of the standard sand drainage layer, and that it is sustainable during this period.

The Advieskamer Stortbesluit concludes, based on the additional TNO-investigation, that the FabriNet HF-E B120 drainage mat has a technical lifetime of at least 100 years.

As to the conclusions, the following boundary condition is valid:

The advice applies to those situations where the FabriNet HF-E B120 drainage mat is used on waste disposal sites, where during design and installation the maximum tolerances of the material have been considered, the installation has been done conforming the quality management and during installation and management stage the previously determined tolerances of the mat (settling, penetrating water, etc.) are not surpassed and that during the operation and management stage there are no external influences, such as penetrating root growth or otherwise.

This advice has been determined on March, 18th 2014 by the Advieskamer Stortbesluit.

2 General data

Data applicant

Name first applicant for advice : GSE Lining Technology GmbH
Contact : Mrs C. Tarnowski
Adress : Normannenweg 28
Zip-code + place : 20537 Hamburg, Germany

Relevant data advice path

Order to ENBB : May 2009
Acceptance ENBB-advice 015 : October, 22nd 2009
Acceptance TNO-advice : July, 20th 2012
Acceptance adapted concept-ENBB-
advice 015 : August, 15th 2013
First consultancy finalization ENBB-
advice by AKS : August, 28th 2013
Order to AKS : December, 13th 2013
Determination concept-advice : February, 18th 2014
Determination advice : March, 18th 2014

3 Scope of advice

3.1 Questions

In the order given to the Advieskamer Stortbesluit the request of the principal has been determined. This is: request for formalisation of ENBB advice GSE drainage mat August 2013.

3.2 Main Question

In the original ENBB-advice (October 2009) there has already been done an extended evaluation of the equivalence of the drainage mat with regard to the standard sand drainage layer. There is another evaluation, stating that the drainage mat is "sustainable". This advice has been published in accordance with the working method of the ENBB valid at that time, with an extended review by several experts of the ENBB-Commission of that time. According to the Advieskamer Stortbesluit it is not necessary to repeat this investigation completely or partially.

Consequently, the Advieskamer Stortbesluit has translated the request of GSE in the following investigation question:

Based on the supplied – not formally published – ENBB Advice 015, version August 15th, 2013 – including the TNO-advice – is it possible to quantify the sustainability of the GSE FabriNet HF-E B120 drainage mat and, if yes, in which period?

3.3 Partial questions

Based on this main question, there have been made three partial questions:

- (1) Does the TNO-investigation Ageing GSE Fabrinet HF-E B120 fulfil the corresponding requirements?
- (2) Are the findings of the ENBB-advice 015, version October, 22nd 2009 with regard to the equivalence anno 2014 still valid?¹
- (3) Are the findings of this TNO-investigation correctly interpreted and integrated in the ENBB-advice 015 version August, 15th 2013?

3.4 Delimitation

The advice to be emitted only applies to the GSE Fabrinet HF-E B120 drainage mat of GSE. Other products of GSE or drainage mats of other suppliers have not been evaluated and are thus not integrated in this advice.

The lifetime investigated in this advice is a technical lifetime. The functional lifetime is determined by the technical lifetime as well as by several boundary conditions in the design, installation, management and exploitation stage. These boundary conditions are not considered in this advice.

¹ Although there is no doubt whatsoever as to the quality of the advice of the former ENBB, it is possible that other opinions could lead to another advice. Consequently the Advieskamer Stortbesluit has realised here a limited review of the ENBB-advice.

3.5 Plan of approach

In order to reply to the partial question 1 we have evaluated whether the TNO-investigation has been defined according to the current standards. These standards are indicated in the article "Long-term performance and lifetime prediction of geosynthetics" from 2008.

In order to reply to the partial question 2 the ENBB-advice 015 – version 22 October 2009 has been evaluated, more specifically there has been a review of the available calculation methods.

In order to reply to the partial question 3 the ENBB-advice 015 – version 15 August 2013 has been evaluated as to modifications with regard to the version of October, 22nd and whether these modifications are a logical result of the realised TNO-report.

4 Conclusions and recommendations

4.1 Reply to the partial questions

Based on its findings, the Advieskamer Stortbesluit has the following replies to the partial questions.

- 1) Does the TNO-investigation Ageing GSE FabriNet HF-E B120 fulfil the corresponding requirements?
 - *Based on its findings, the Advieskamer Stortbesluit concludes that the TNO-investigation has been conducted in accordance with the valid standards.*
- 2) Are the findings of the ENBB-advice 015, version October, 22nd 2009 with regard to the equivalence anno 2014 still valid?
 - *Based on a review done on the calculations in the ENBB-advice, considering the opinions anno 2004, the Advieskamer Stortbesluit concludes that the findings of the ENBB-advice with regard to the equivalence to the standard reference layer have not been changed and are consequently still valid.*
- 3) Are the findings of this TNO-investigation correctly interpreted and integrated in the ENBB-advice 015 version August, 15th 2013?
 - *Based on its findings, the Advieskamer Stortbesluit concludes that the TNO-investigation has been correctly interpreted and integrated in the ENBB-advice version August, 15th 2013.*

4.2 Reply to the main question

Based on its findings, the Advieskamer Stortbesluit replies as follows to the main question.

“Based on the supplied – not formally published – ENBB Advice 015, version August 15th, 2013 – including the TNO-advice – is it possible to quantify the sustainability of the GSE FabriNet HF-E B120 drainage mat and, if yes, in which period”.

- *Based on the supplied documents and after evaluating the used methods, the technical lifetime of the GSE FabriNet HF-E B120 drainage mat can be determined on at least 100 years.*

4.3 Conclusions based on the investigation

Based on its findings, the Advieskamer Stortbesluit concludes as follows:

- *The Advieskamer Stortbesluit confirms the conclusion of the ENBB-advice 015 – Version August, 15th 2013 stating that the FabriNet HF-E B120 drainage mat for the further on indicated technical lifetime is equivalent to the standard sand drainage layer and that it is sustainable during this period.*
- *The Advieskamer Stortbesluit concludes based on the additional TNO-Investigation that the FabriNet HF-E B120 drainage mat has a technical lifetime of at least 100 years.*

For the conclusions the following boundary condition applies:

- *The advices applies to the situations where the FabriNet HF-E B120 Draining mat is used on waste disposal sites, where for the design and the installation following is considered: the maximum tolerances of the material, the installation conforming to the quality management and during the operation and management*

term the previously determined tolerances of the mat (settling, penetrating water, etc.) is not surpassed and that during the operation and management stage there are no external influences, such as penetrating root growth or otherwise.

Annexes

Annex 1: Responsibility

Principle of independence

Herewith Mr C.J. Meijler, president of the Advieskamer Stortbesluit, declares that the advice "Sustainability GSE FabriNet HF-E-B120 drainage mat; addition ENBB-advice 015", dated march, 18th 2014, fulfils the principle of independence, as defined in the Guideline Advieskamer Stortbesluit, version 1.0.

Participants

The following people participated in the realisation of this advice:

In name of Advieskamer Stortbesluit:*)

Mr C.J. Meijler	President Advieskamer Stortbesluit
Prof. Dr Ir A. Bezuijen	Delegate in name of Advieskamer Stortbesluit
Prof. Dr Ir A. Bezuijen	Member Advieskamer Stortbesluit
Prof. Ir J.W. Bosch	Member Advieskamer Stortbesluit
Dr. J. Breen	Member Advieskamer Stortbesluit
Prof. Dr A.M. Breure	Member Advieskamer Stortbesluit
Prof. Dr Ir T.N. Olsthoorn	Member Advieskamer Stortbesluit
Ir J.F. de Boer	Secretary Advieskamer Stortbesluit

*) *Although Mr. Breen is a permanent member of the Advieskamer Stortbesluit, in this case he has not participated in the deliberations and decision as to the advice. The reason is that - before being member of the Advieskamer Stortbesluit - he has done investigation for the order of GSE as to the sustainability of the corresponding drainage mat.*

Conformity check

In order to stimulate a good applicability of the advice, the Advieskamer Stortbesluit presents the concept-advice to the party requesting the advice in order to check the advice as to conformity with the questions. This does not imply the contents, but merely whether the advice gives an answer to the question.

In this way, the Advieskamer Stortbesluit at the same time has given the opportunity to the party requesting the advice to check the concept-advice as to incorrectness and to the conformity of the advice with the questions.

The reaction has been evaluated by the Advieskamer Stortbesluit before stating the final advice.

The Advieskamer Stortbesluit can also decide to imply the final user of the advice in the determination of the final questions and the check of the concept-advice as to conformity with the questions. This is the case in the following situations:

- The requested advice is (also) aimed at getting a licence: the specified question is presented to competent authority/authorities.
- The requested advice contains elements being relevant for the after-care situation after the management of the disposal site(s) has been transferred to the provincial authority: the specified question is presented to the corresponding provincial authority/authorities.
- The requested advice contains elements being relevant for the interpretation of the disposal rules: the specified question is presented to the Ministry..

The advice is not directly² aimed at getting a licence of a competent authority, does not contain any other elements referring directly to the after-care situation of waste disposal

² *One may say that the drainage mat can be applied on disposal sites and that there is consequently a relation with getting a licence or with the after-care situation. However, the Advieskamer Stortbesluit thinks, if the corresponding drainage mat is used in a real situation (that is to say: on a disposal site), not GSE, but the actual user (the management of the disposal site) is responsible for the contacts as to getting a licence and the after-care situation.*

sites and any elements being relevant for the (interpretation) of the disposal rules. Consequently, as to the conformity test, the intervention of competent authority, provincial authority or Ministry has been renounced.

Annex 2: Sources

Consulted experts

1. Ir. D. Boels, Feelance Bureau Boels / former secretary ENBB
2. Dr J. Breen, KIWA Technology / vh TNO Technical Sciences

Documents and data supplied by the party requesting the advice

1. ENBB-advice 015, October 2009, ENBB³
2. ENBB-advice 015, version August, 15th 2013, Ir. D. Boels
3. Ageing GSE Fabrinet HF-E B120, July, 30th, TNO Technical Sciences, Dr. J. Breen

Other documents and data used by Advieskamer Stortbesluit

1. Long-term performance and lifetime prediction of geosynthetics, EuroGeo4 Keynote Paper, Edinburgh 2008, Y. G. Hsuan (Drexel University Philadelphia, USA), H. F. Schroeder (BAM Berlin, Germany), K. Rowe (Queens University Kingston, Canada), W. Müller (BAM Berlin, Germany), J. Greenwood (E.R.A. Technology Ltd, UK), D. Cazzuffi (CESI SpA, Italy), R.M. Koerner (Geosynthetic Institute, Folsom, USA)

³ ENBB per 2009: Ir. D. Boels, WUR-Alterra (overall coordinator ENBB), Dr. J. Breen, TNO-Industrie en Techniek, C. van Ommeren, Quality Services BV, Dr. Ir. C. W. Versluijs, RIVM, Ing. W. van der Zon, Koninklijke VOPAK nv
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