

T r a n s l a t i o n o f F I N A L P R O J E C T R E P O R T

No. 5704-08-2018/2019-BR

Client: Bona Vertriebsgesellschaft mbH Deutschland
65549 Limburg an der Lahn

Content: Report on the documented insights/findings regarding the efficacy of using the Bona Elastic system in hygiene-relevant areas as a preventative measure, on the one hand to avoid contamination around joints and on the other hand to optimise the cleaning and disinfecting of newly installed/glued synthetic designer flooring planks/elements and elastic floorings in place

Project plan: Fulfilment of the requirements for floor surfaces/coverings in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc.

System products: Renovation and maintenance system for elastic floor coverings
"Bona Elastic System"

Flooring: Standard synthetic designer flooring in the form of planks/elements

Date: 14.08.2019

Copies: 1
+ PDF-file

Text pages: 63

Colour photos: 66

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"Seite"

- 66 colour photos integrated

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Cologne, 14.08.2019
File Ref. IFR-Az.: 5704-2018 ki-ko – please cite in all correspondence!

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PRELIMINARY COMMENTS

Upon written confirmation of order and scheduling on 05.11.2018 and expansion of the order on 06.05.2019 the technical experts firm of IFR Sachverständigenbürogesellschaft für Fußbodentechnik und Raumausstattung mbH Köln was commissioned by the Bona Vertriebsgesellschaft mbH Deutschland, 65549 Limburg an der Lahn, within the frame-work of the project to investigate use of the system in hygiene-relevant areas in accordance with the requirements for floor surfaces/coverings in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc. to prepare this

FINAL PROJECT REPORT

which is hereby presented in a single copy including photographic documentation and as a pdf document.

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Basic information on the subject of "hygiene-relevant areas"

The installation/gluing of elastic floor coverings in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc. has proved reliable for decades and, among other things with regard to heat welding and grouting of the joints between adjacent lengths of flooring and the formation of hygienic skirting/hollow groove boards, it is compliant with the guidelines on hospital hygiene and infection prevention issued by the Robert Koch Institute, 13353 Berlin.

The increasingly popular use/application of synthetic designer flooring as planks and tiles which are laid "flush" at the joints and not grouted or heat welded has in the past led to discussion on whether flooring surfaces made up of a comparatively large number of small individual sections in the form of planks and/or tiles which are not heat welded or grouted at the joints satisfy requirements in hygiene-relevant areas.

On this aspect among others, besides the Robert Koch Institute's guidelines on hospital hygiene and infection prevention, the "Technical rules for biological agents; biological agents in healthcare and welfare facilities TRBA 250" were consulted, which states the following, inter alia, under Point 1.2.3 "Surfaces, disinfection":

"...

All surfaces must be impermeable to water, easy to clean and resilient against the disinfectants and chemicals used.

The finish must be smooth and seamless.

Corners and edges of the area should preferably be rounded to enable easier cleaning/disinfection.

..."

Consequently, in August 2016 the company IFR Köln contacted various ministries and regional authorities and asked for responses to clarify the situation on this topic.

Advice from Ministries/Regional Authorities

As examples, the responses of individual ministries/regional authorities which have made statements on the topic described are given below.

For example the **Bavarian** Regional Authority for Health and Food Safety responded our enquiry, inter alia, as follows:

"...

Joints should be avoided as far as possible, any gaps in flooring laid flush or at intersections between the floor and the wall cannot be tolerated.

In these areas moisture can penetrate and also be released again, which can encourage both the entry and multiplication of bacteria and can also lead to detachment of the flooring.

..."

The Ministry for Social Affairs, Health, Science and Equality gave the following advice, inter alia, through their representative for infection protection, specialist in hygiene and environmental medicine, **Kiel**:

"...

'sealed joints' means: the surface is designed so that disinfecting solutions do not penetrate the material when it is mopped with disinfectant and prevent any changes or swelling of the flooring. Penetration of solution into the material can lead to damage and unevenness and impair the capacity for disinfection.

This must be avoided. Thus, sealed joints is to be understood in the sense of impermeability to liquids.

How impermeability of the surface is to be ensured is not stipulated.

..."

The Regional Health Authority of **Lower Saxony** writes on this topic:

"...

We share your opinion that the sealing of PVC flooring in areas at risk of contamination is sensible if the flooring is not laid in one piece and therefore has joints. We would point out that we are referring only to the hygiene requirements and not to occupational safety, material characteristics or other aspects.

..."

The **Saxony-Anhalt** Regional Authority for Consumer Protection made the following statement through the Head of Department 21 - Health & Hygiene Management:

"...

It is important that the joints are smooth and watertight, i.e. that fluid reservoirs cannot form there. So the precautionary sealing of joints that you recommend is a good way to ensure that no moisture can penetrate. It must be borne in mind that the seal must be resilient against disinfectants.

..."

The **Baden-Wuerttemberg** Ministry for Social Affairs and Integration provided the following advice upon enquiry by the company IFR Köln:

"...

The flooring in procedural rooms and operating theatres is subject to especially high load due to the constant traffic of beds, equipment stands and heavy, rolling appliances and due to the sometimes aggressive cleaning and disinfection with chemicals.

It should therefore fulfil the following requirements: sealed joints and completely smooth, resistant to abrasion and mechanically robust, resilient against liquids and disinfectants and sufficiently non-slip.

In addition it should be antistatic, conductive and connected to equipotential bonding. The conductivity (contact resistance $\leq 10^9 \Omega$ in line with EN 14 041) should protect sensitive electronic life support machines against malfunction and damage from electrostatic discharge, prevent the ignition of gas and air mixtures and protect operators and patients from stray voltage during high frequency surgery.

A suitable flooring is, e.g. a conductive, fully heat sealed artificial rubber or PVC flooring. Alternatives are epoxy resin multi-layer floorings or sanded and polished terrazzo. The floor tiles used in the past are less recommended. The grouting makes them more difficult to clean, the hardness and sound of foot-falls also makes it uncomfortable to stand on for longer periods.

Joints are problematic since they absorb impurities and moisture and are difficult to clean and decontaminate in day-to-day use. Floor coverings can be sealed seamlessly using, e.g. polyurethane lacquer or PVC coatings, whereby the evenness of the surfaces must be maintained..

..."

The Health Authority of **Bremen** answered our enquiry as follows:

"...

In line with Robert Koch Institute recommendations, the joints must also be impermeable to liquids and must not form or enable reservoirs where impurities can collect.

The intersections, for instance to walls, must also be designed accordingly. It is important in every case that the whole surface can be easily and thoroughly disinfected and cleaned using standard processes.

Flooring which is only laid flush can in our view not fulfil these conditions.

..."

The Regional Investigative Authority for the Healthcare and Veterinary Sector in **Saxony** writes:

"...

In terms of semantics a floor has 'sealed joints' if it in fact has no joints or if these are appropriately sealed. So if in the case of standard installation (e.g. flush) joints remain, even if these are only very narrow cracks, subsequent sealing, for instance with lacquer, can satisfy this requirement for sealed joints.

..."

In our capacity as technical experts we were required to make a similar enquiry on this topic to the Health Authority for Hygiene in Health-care Facilities of the City of Cologne.

With reference to TRBA 250 "Technical rules for biological agents; biological agents in healthcare and welfare facilities" the health authority of the City of **Cologne** stated the following:

"...

Based on the legal provisions or recommendations set out above, flooring in medical practices should be designed or installed so as to ensure that reliable disinfection of the surface is possible in case of contamination.

In the case of flooring which is laid flush in plank form, it is our view that this is not ensured.

Even if any resulting joints have a width in the range of 0.1 mm, microorganisms can penetrate which can then no longer be completely removed by subsequent disinfection measures.

..."

Finally, the **Federal State of Brandenburg** or the Regional Authority for Occupational Safety, Consumer Protection and Health set out the following advice in its response to the letter from August 2016:

"...

that the professional trades and commercial firms in Germany which install flooring should be informed of explicit hygiene requirements.

The professional trades and commercial firms can take an advisory role – but not on infection prevention; because the hygiene requirements for structural function specifications must be established by the sponsor/operator of the medical facility specifically for the facility in line with risk analysis.

..."

Conclusions from the Responses of Ministries/ Regional Authorities

With regard to the content cited above as examples for the responses of ministries/regional authorities, there is an obvious urgent need for action to establish whether and to what extent contamination can occur when liquids on the surface of floors made up of synthetic designer flooring planks and elements collect in the seams and partly unavoidable joints and are then very difficult to reach in the course of subsequent disinfection and cleaning measures.

As described in this documentary report and illustrated with photos, this situation was examined in the course of this project and at the same time tests were done to establish whether it is possible to avoid/prevent the penetration of potentially contaminating liquids around the seams and partly unavoidable joints between installed/glued planks and tiles by the application of a suitable, 2-component polyurethane dispersion lacquer.

As a result, the project on fulfilment of requirements for floor surfaces/coverings in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc. was initiated.

1.0 Project Basis Sample/Test areas

1.1 Preparation of the sample/test areas

Initially two sample/test areas of 2.50 x 4.00 m were created using rimmed wooden support boards which were treated with a standard synthetic dispersion primer and levelled using a standard mineral smoothing compound with an average thickness of 3.0 mm.

On this so prepared sample/test area, synthetic designer flooring planks were then glued along the whole of their length using the fibre-reinforced wet-bed dispersion adhesive "Bona D750 designer flooring adhesive".

In the course of the professional installation/gluing of the synthetic designer flooring planks, particular attention was paid in the first sample/test area to ensure that the planks were laid precisely flush at the joints along both the long and short plank edges so that there were no gaps between the planks.

(Photos 1 to 6)



Photo 1

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Photo 2



Photo 3



Photo 4



Photo 5



Photo 6

In the second sample/test area the same synthetic designer flooring planks were installed/glued also using the fibre-reinforced wet-bed dispersion adhesive "Bona D750 designer flooring adhesive".

(Photo 7)



Photo 7

In this second sample/test area attention was paid to ensure that along the joints of both the long and short edges of the synthetic designer flooring planks, gaps approx. 0.4 mm to 0.6 mm wide were created. **(Photos 8 to 12)**



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12

Creation of the gaps with a width of approx. 0.4 to 0.6 mm between the installed/glued synthetic designer flooring planks serves to establish whether it is possible through subsequent sealing/lacquering of the synthetic designer flooring area it might be possible using the 2-component polyurethane dispersion "Bona Pure" to seal the joints so that liquids on the surface do not get into the gaps and/or under the synthetic designer flooring.

(Photos 13 to 15)

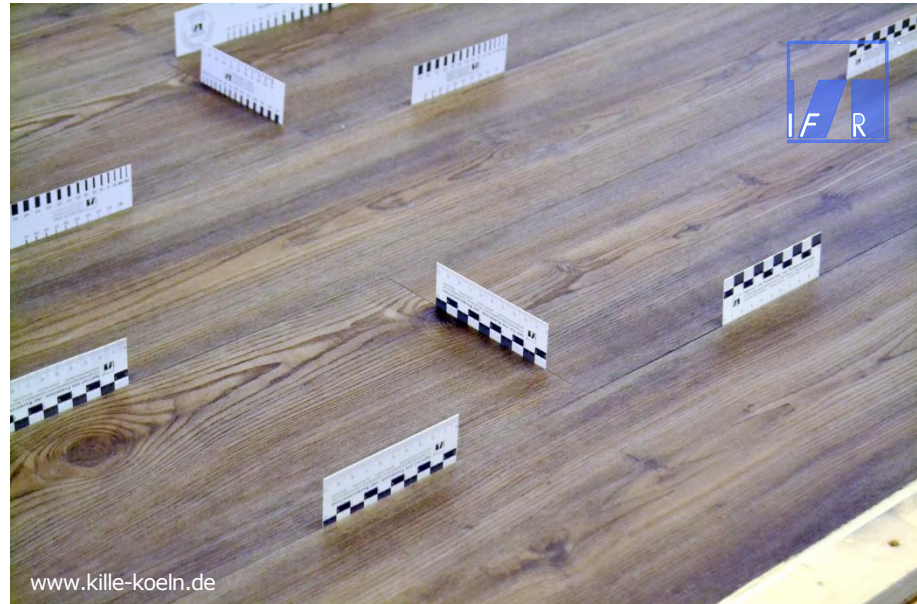


Photo 13



Photo 14



Photo 15

1.2

Sealing of the surface of installed/ glued synthetic designer flooring planks

In order to seal the surfaces of installed/glued synthetic designer flooring planks, the PUR sealant "Bona Pure" from the Bona Elastic System was used.

For this, the rectangular 2.50 x 4.00 m sample/test areas were diagonally marked/divided so that one half of the installed/glued designer flooring planks remained in their original state and the other half was sealed using the 2-component polyurethane dispersion "Bona Pure".

In accordance with the system requirement the surfaces of the halves of the installed/glued synthetic designer flooring planks of the sample/test areas to be sealed were smoothed using a rotary disc machine with a red nylon pad in combination with 120 grit "Bona Diamond Abrasive Disc".

(Photos 16 and 17)



Photo 16

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Photo 17

After sanding, the polished halves of each area of the installed/glued synthetic designer flooring planks were cleaned with floor mops and microfiber cleaning pads using clear water.

(Photos 18 to 21)



Photo 18



Photo 19



Photo 20



Photo 21

After the preparation measures described above the halves of the sample/test areas were sealed in one working step with the 2-component polyurethane dispersion "Bona Pure" in conjunction with the Bona polyester roller observing an average consumption of 120 g/m². **(Photos 22 to 27)**



Photo 22

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Photo 23



Photo 24



Photo 25



Photo 26



Photo 27

1.3

Practice-based deep and maintenance cleaning

14 days after completion of the sample/test areas and the surface sealing described above and before commencement of daily, standard maintenance cleaning, the sample/test areas were subjected to deep cleaning of the whole surface.

For this purpose the "Bona Power Scrubber" cleaning machine, equipped with counter-rotating, cylindrical brushes, was used which is recommended for, among other things, lacquered and oiled wooden floors. **(Photo 28)**



Photo 28

The deep cleaning of both sample/test areas was completed using white cleaning brushes and the basic cleaner "Bona Power Remove R" (1:5 parts cold water). **(Photos 29 to 35)**



Photo 29

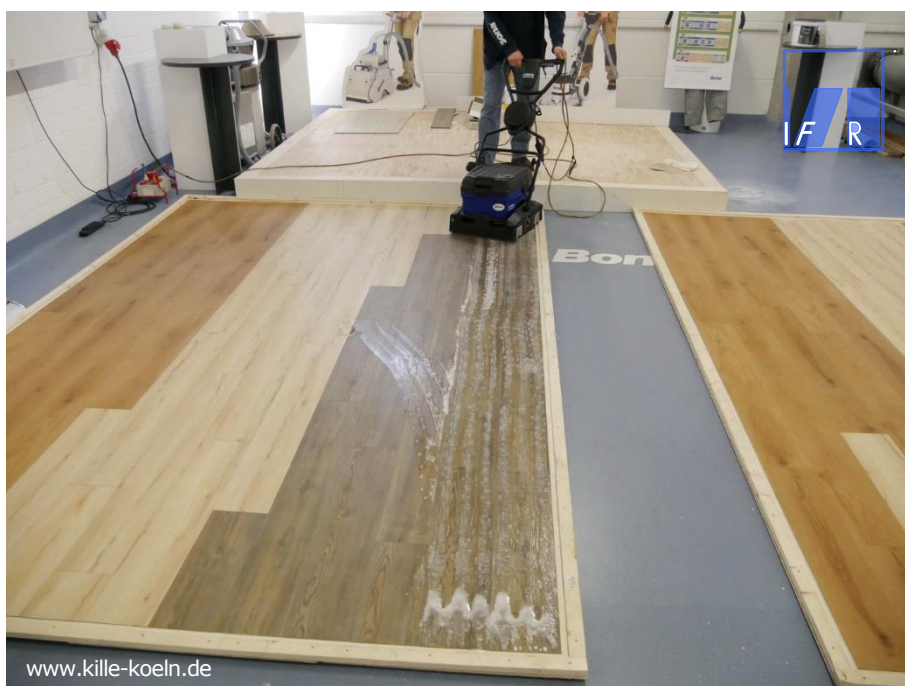


Photo 30



Photo 31

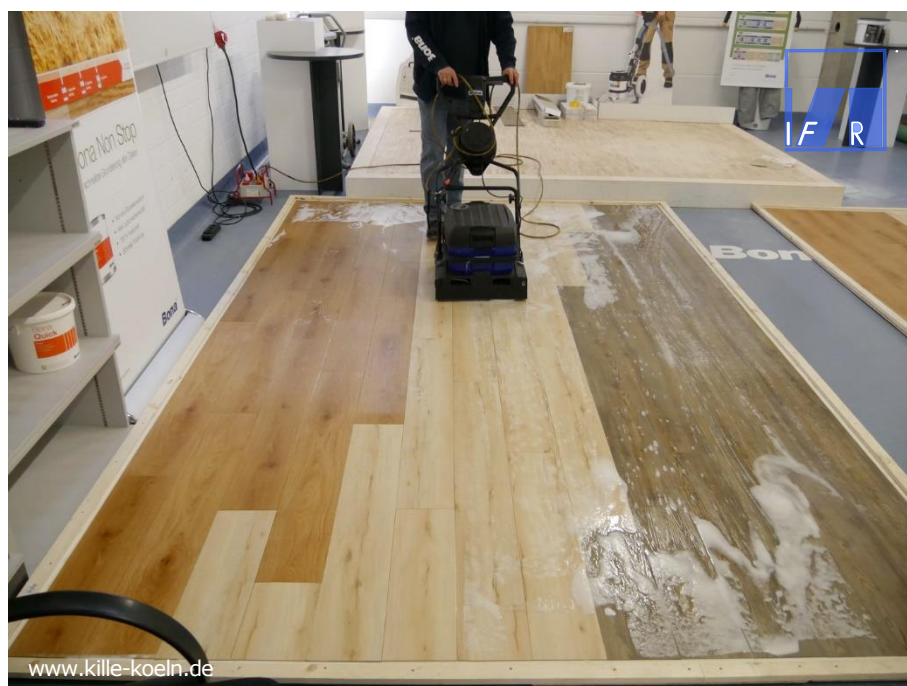


Photo 32



Photo 33



Photo 34



Photo 35

To complete the deep cleaning the sample/test areas were "re-rinsed" with clear water and vacuumed. **(Photos 36 and 37)**



Photo 36



Photo 37

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Note:

To enable easy identification of residues, the luminescence pigment LUMILUX® Dispersion Yellow CD 997 was added to both the cleaning fluid used for the deep clean and the cleaning fluid used for maintenance cleaning (wiping down).

In combination with forensic or ultraviolet light equivalent to wavelength 365 nm, the cleaning fluids appeared fluorescent yellow-green so that relevant residues of the cleaning fluids, for instance in lower joint areas, were made visible.

(Photos 38 and 39)



Photo 38

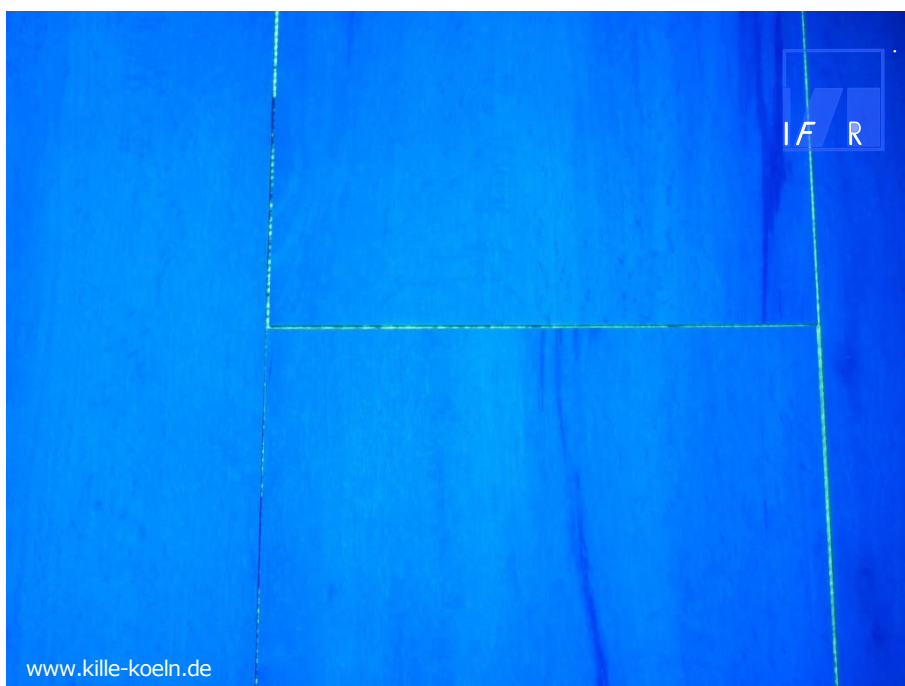


Photo 39

The prepared sample/test areas were then cleaned daily on the workdays of a period of around 8 weeks using a mop with the cleaning fluid "Bona Clean R50" in a mixing ratio of 1:200 (50 ml to 10 l of water).

1.4**Examination of
the sample/test areas**

In accordance with the project plan and the purpose of the measures, the trial/sample areas were examined as to whether there were fluorescent residues of cleaning fluids, for instance around the joints/gaps or under adjacent, installed/glued synthetic designer flooring planks and whether any difference was visible to the halves of the areas sealed using the 2-component polyurethane dispersion "Bona Pure".

The two sample/test areas displayed a visually perfect appearance before the start of the test.

(Photo 40)



Photo 40

The first sample/test area examined was the one in which the synthetic designer flooring planks were deliberately installed/glued leaving approx. 0.4 to 0.6 mm wide gaps. **(Photo 41)**



Photo 41

When examined in detail it can be clearly seen that, corresponding to the diagonal division of the rectangular sample/test area, the right half of the area was sealed with the 2-component polyurethane dispersion "Bona Pure", whilst the left half remained in its original state.

(Photo 42)

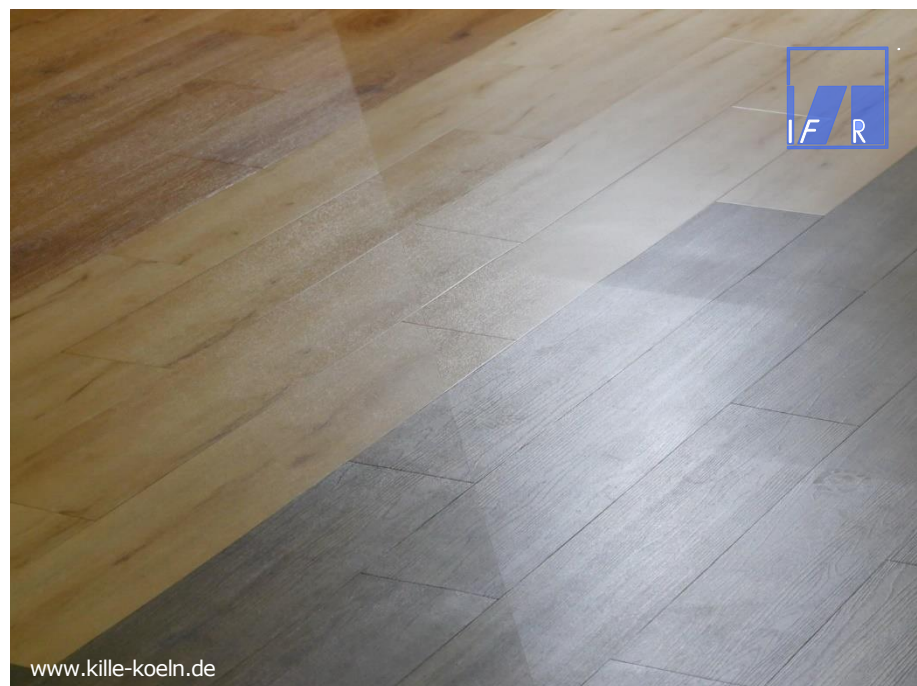


Photo 42

The sample/test area was examined forensically under ultraviolet light with the crime scene lamps "LUMATEC SUPERLITE M 05" using the lamp head appropriate for the spectrum UVA 365 nm.

(Photos 43 and 44)



Photo 43

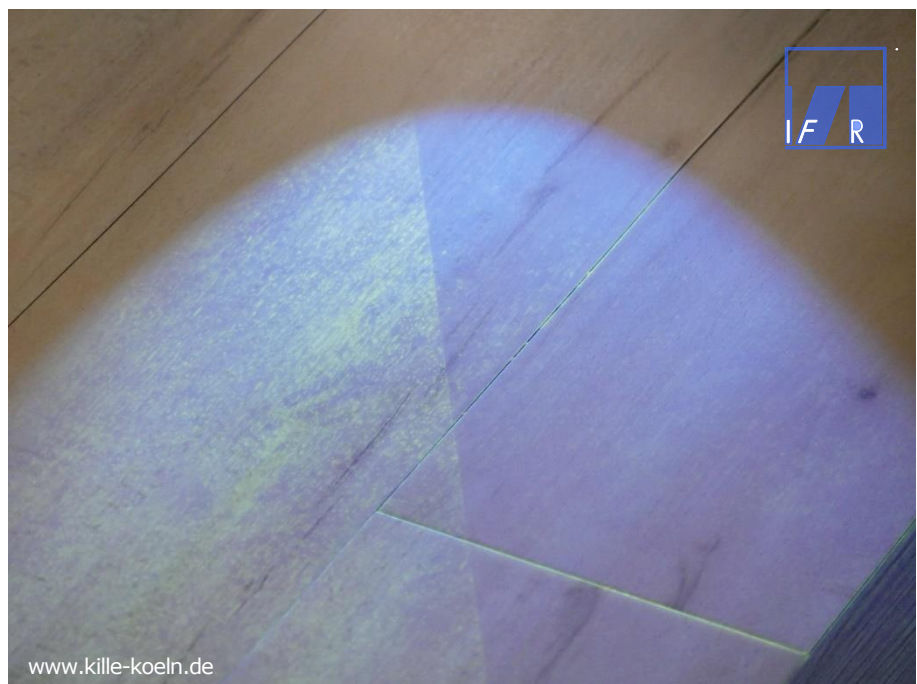


Photo 44

This showed firstly that on the surface of the synthetic designer flooring planks left in their original condition there were residues of cleaning fluids and secondly that there were residues of cleaning fluids inside the joint spaces. **(Photos 45 and 46)**

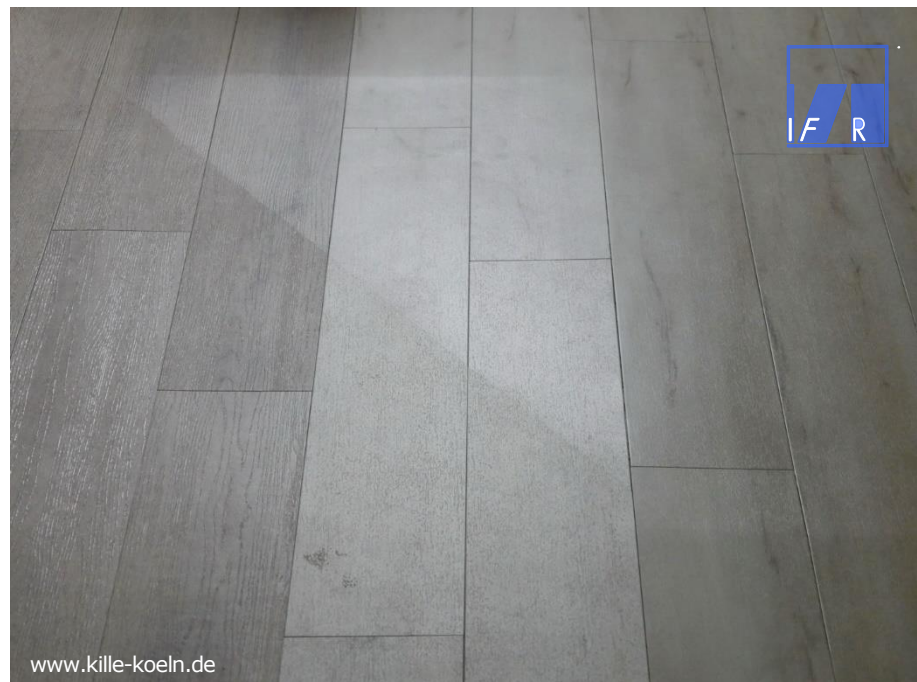


Photo 45



Photo 46

Within the area shown on photos 45 and 46 (see also **Photo 47**) the flooring around the intersection between the sealed and non-sealed surface was lifted from the sub-surface. (**Photo 48**)



Photo 47

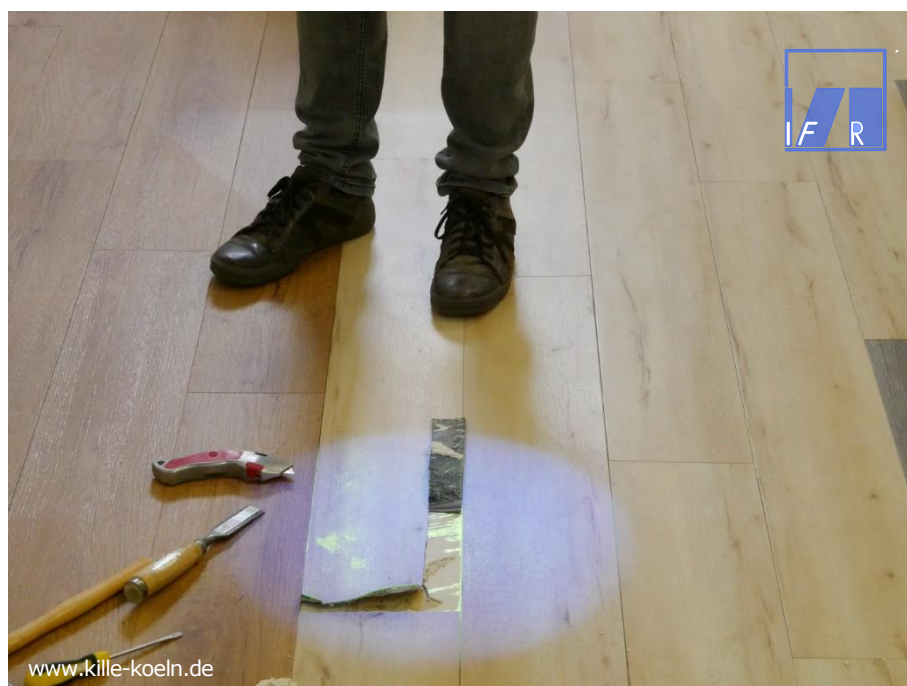


Photo 48

When examined in detail it was established that, besides the cleaning fluid residues on the surface of the synthetic designer flooring left in its original condition, there were also considerable residues of cleaning fluid inside the open joints, which had also seeped behind/under the synthetic designer flooring. **(Photos 49 and 50)**

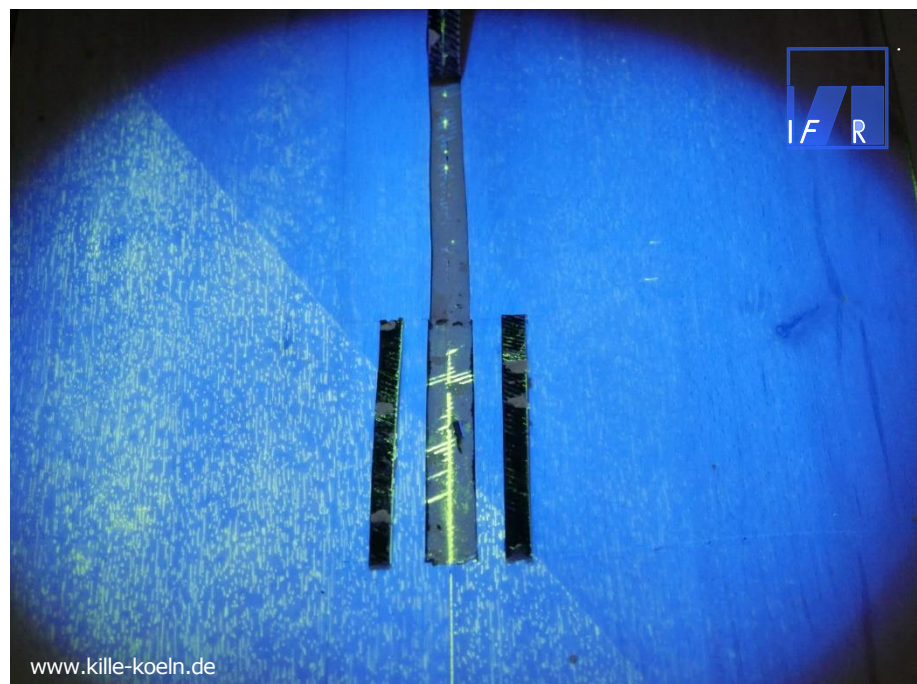


Photo 49

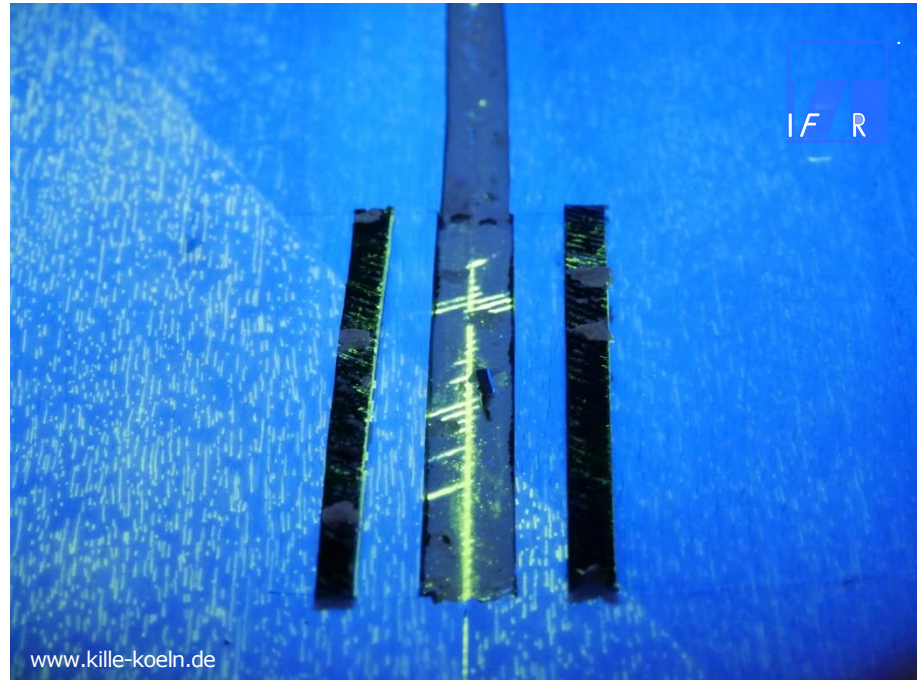


Photo 50

In the examinations using the crime scene lamp, it was established repeatedly that the cleaning fluid had collected not only within the open joints of adjacent synthetic designer flooring planks, but had also seeped behind/underneath the synthetic designer flooring via the joint spaces.

(Photos 51 and 52)



Photo 51

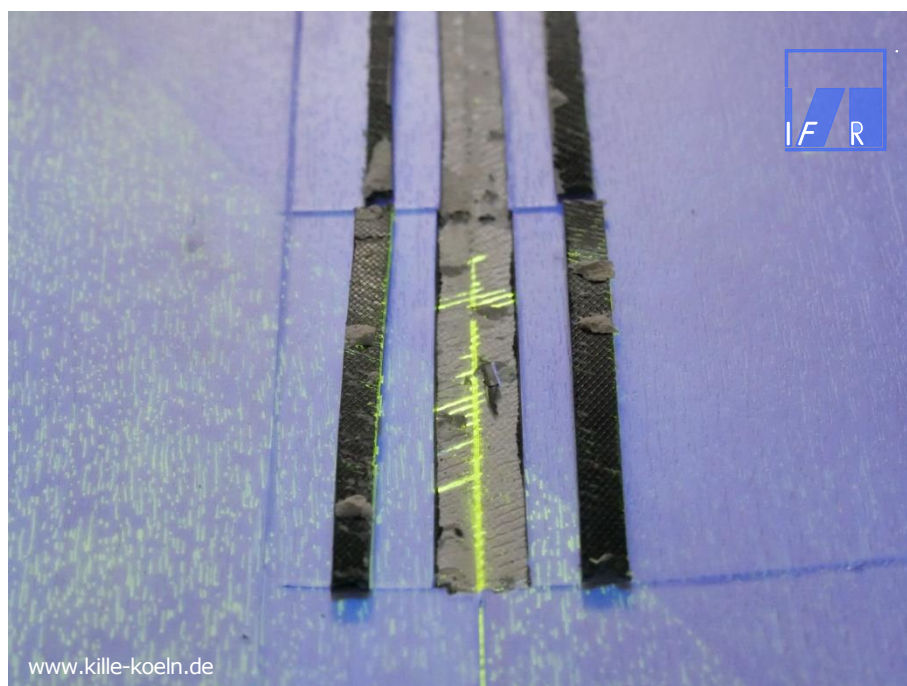


Photo 52

In comparison to this, in the area sealed with the 2-component polyurethane dispersion "Bona Pure" only traces of cleaning fluid residue were established around the joints. (see again **photo 49**).

In this area one application (approx. 120 g/m²) of the 2-component polyurethane dispersion "Bona Pure" did not completely seal the relatively wide gaps of approx. 0.6 mm in some places.

After this, an examination was made of the sample/test area in which the synthetic designer flooring planks had been installed/glued perfectly properly from a professional viewpoint "tightly flush" along the long and short end joints.

(Photo 53)



Photo 53

It is clear to see on **photo 53** that the diagonally divided sample/test area is sealed in the background upper section, whereas on the foreground lower section the surface of the installed/glued synthetic designer flooring planks remained in their original condition, as is shown again in more detail on **Photo 54**.

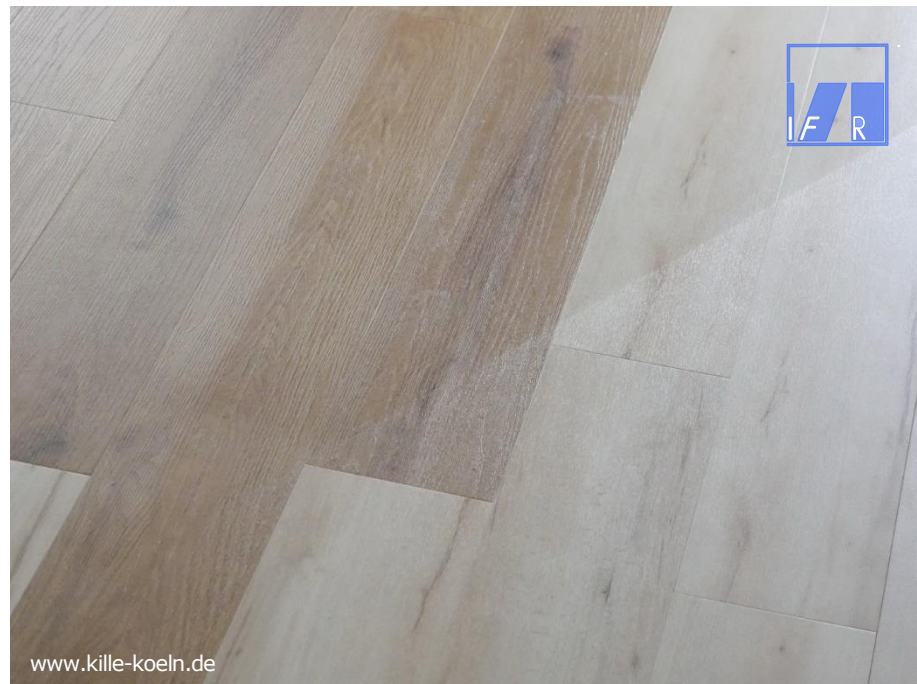


Photo 54

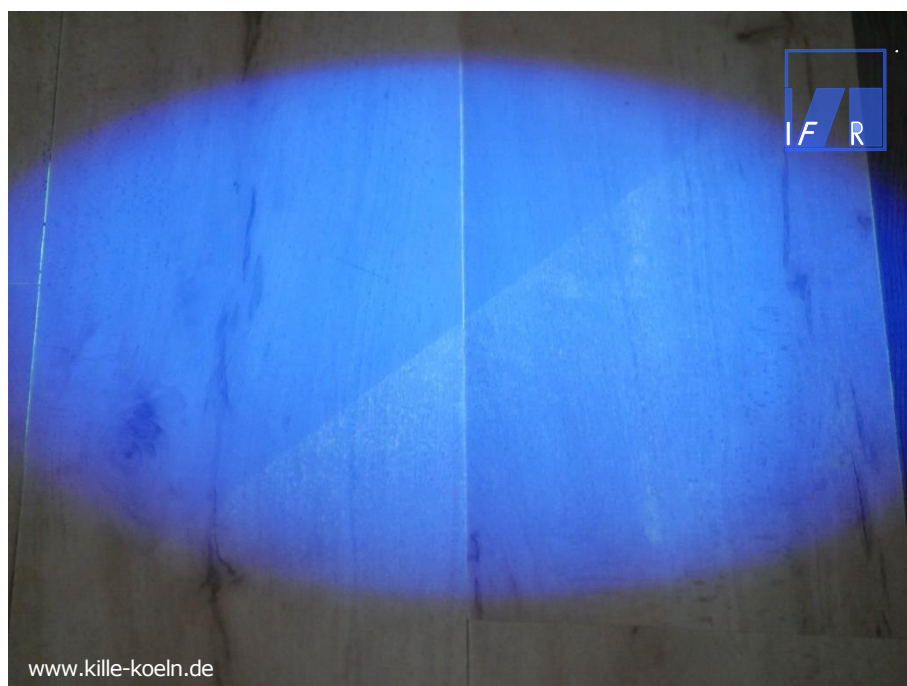
Whilst the difference between the sealed and unsealed surfaces is recognisable at a glance, when examined forensically with crime scene lamps "LU-MATEC SUPERLITE M 05" using lamp head UVA 365 nm, a residue of cleaning fluid is clearly visible on the surface of the planks not additionally sealed with the 2-component polyurethane dispersion "Bona Pure", as well as along the joints of the planks.

(Photos 55 and 56)

Photo 55



Photo 56



In order to investigate whether and to what extent the cleaning fluid penetrated between the joints of the synthetic designer flooring planks installed/ glued tightly flush, the long edges of adjacent planks were first cut and then lifted from the sub-surface.

In this process it was established that the cleaning fluid had penetrated around the joints of the surface of the synthetic designer flooring planks not subsequently sealed and seeped behind/ underneath the flooring.

(Photos 57 and 58)



Photo 57

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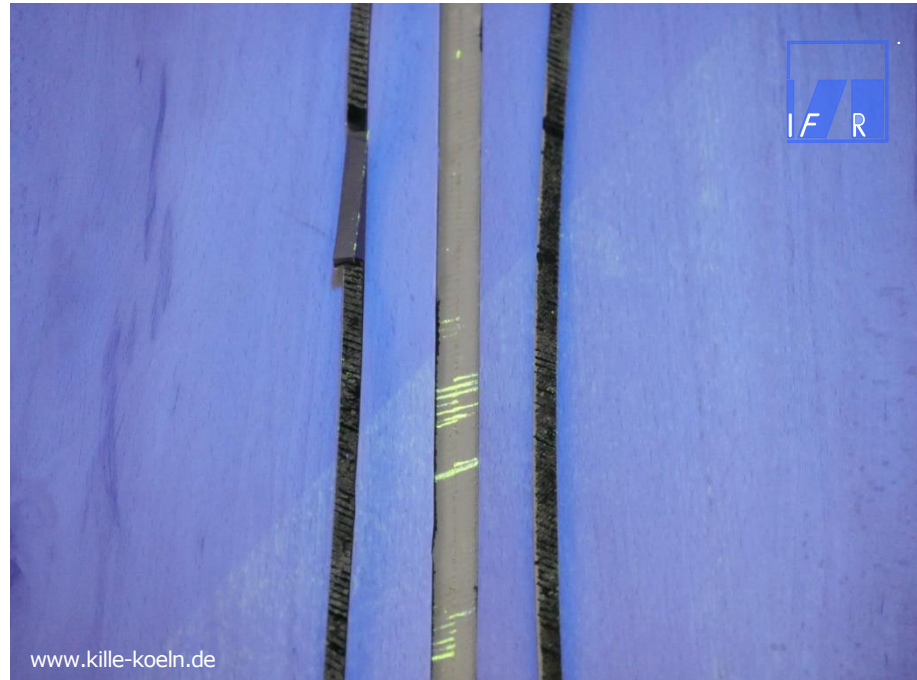


Photo 58

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Upon detailed examination it was clear that the cleaning fluid had got in via the joints of adjacent synthetic designer flooring planks as far as the sub-surface where it had seeped behind/underneath the flooring through "hollow channel-like areas" between the compromised adhesive ridges.

(Photos 59 and 60)



Photo 59



Photo 60

In comparison to this, it was established that along the tightly sealed joints of the sealed surface of the synthetic designer flooring planks there were only traces of cleaning fluid residues. **(Photo 61)**

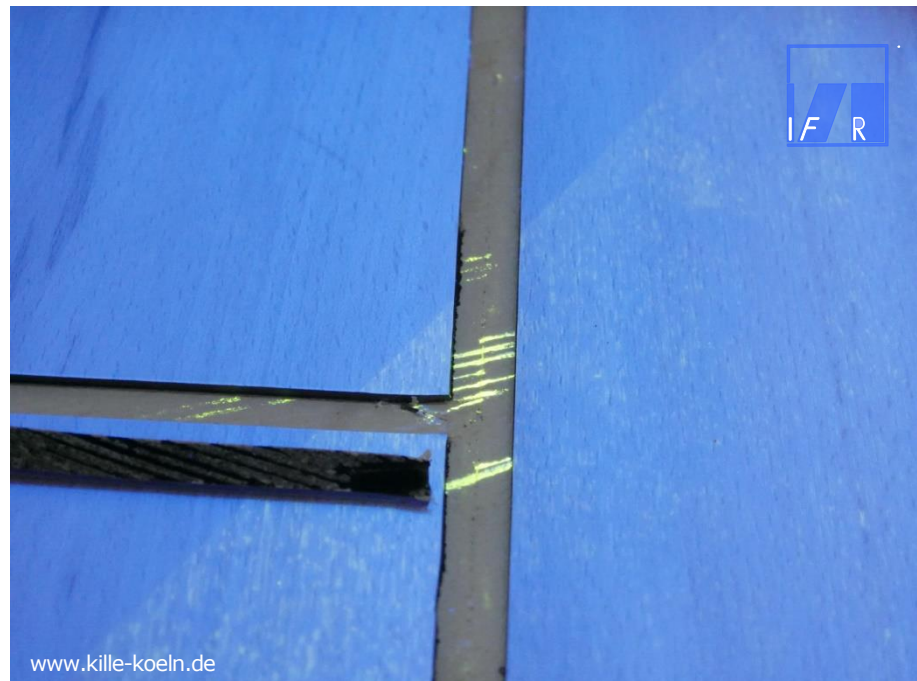


Photo 61

Due to the optimal adhesion of the synthetic designer flooring planks it was no longer possible to remove/peel these off from the underlying surface undamaged as complete planks, so instead efforts were made to detach the flooring from the sub-surface step by step in strips, particularly in the area which had remained in its original condition.

(Photos 62 to 64)

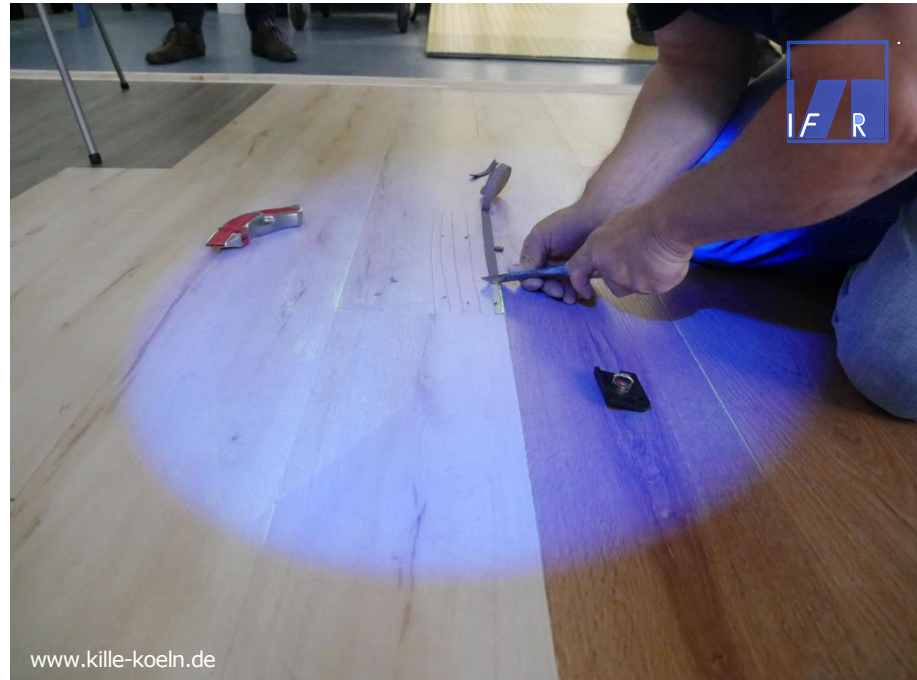


Photo 62

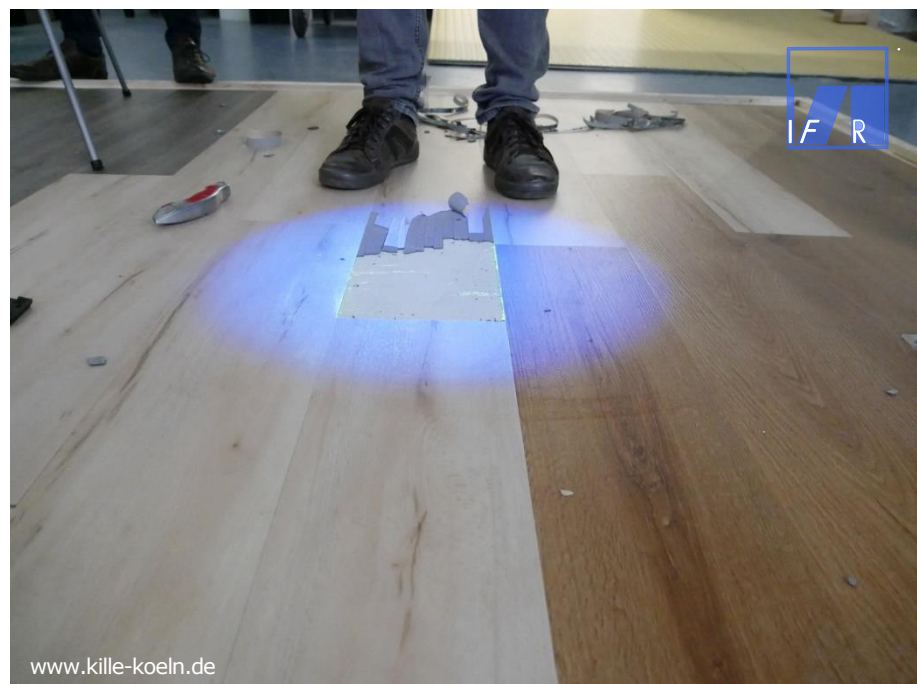


Photo 63

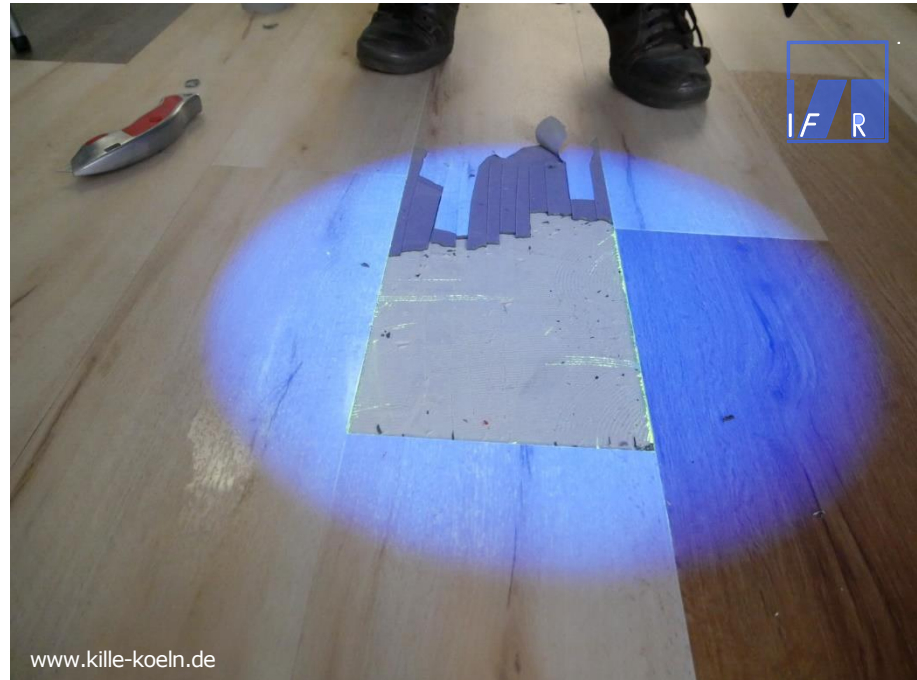


Photo 64

After partial sections of the synthetic designer flooring planks were detached from the sub-surface it was clearly visible that cleaning fluid had got in under the flooring through the gaps between adjacent synthetic designer flooring planks laid flush, i.e. the cleaning fluid had seeped behind/under the flooring. **(Photos 65 and 66)**

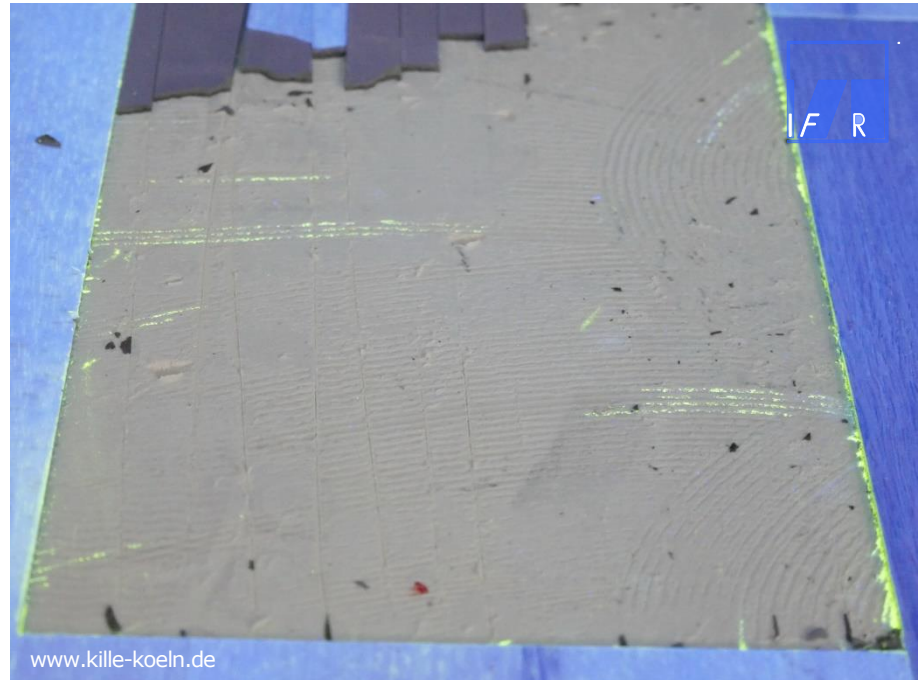


Photo 65

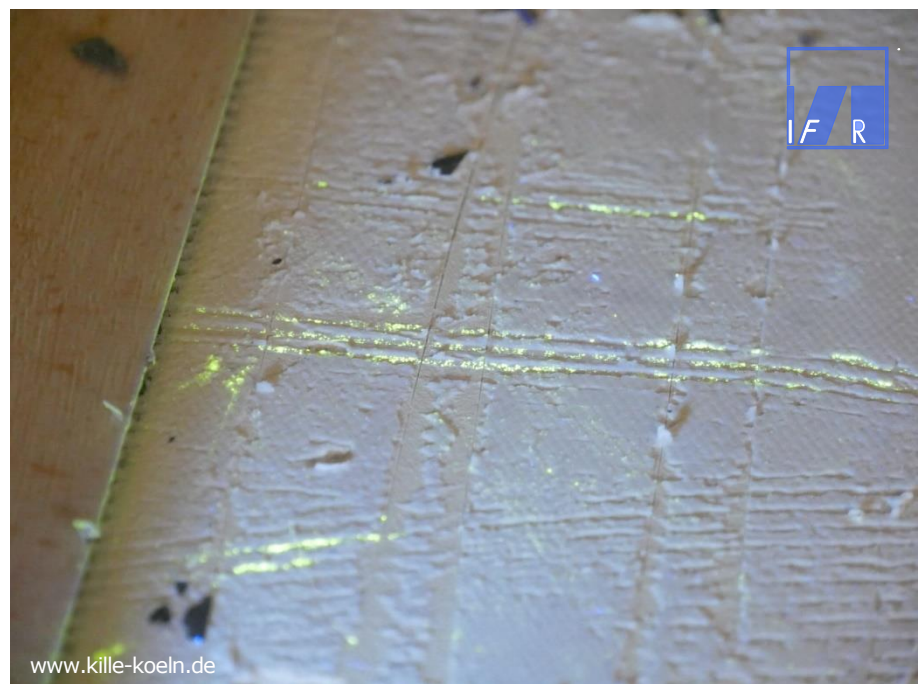


Photo 66

2.0**SUMMARY
of insights from the project****2.1****General information**

The hygiene requirements for floor coverings/ coatings in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc. are specified in, among other things, regulations, information leaflets and guidelines by interest groups, ministries and authorities of the Federal States and Federal authorities.

For example the "Guideline for Hospital Hygiene and Infection Prevention" issued by the Robert Koch Institute, both a standard reference work for hygiene officials and the administrations in hospitals, old people's homes and surgical facilities and as a basis for hospital and medical practice architects.

The "Technical rules for biological agents; biological agents in the healthcare and welfare facilities TRBA 250" were drawn up under leadership of the specialist sector Healthcare and Welfare Facilities (FB WoGes) of the German Social Accident Insurance (DGUV) and also define the properties of surfaces as follows:

"...

surfaces (floors, work surfaces, the surfaces of working appliances) must be easy to clean and resilient against the cleaning fluids and any disinfectants used.

..."

The TRBA is applicable to activities with biological agents in sectors of healthcare and welfare facilities in which persons are medically examined, treated or nursed.

With the reference to TRBA 250 "Technical rules for biological agents in healthcare and welfare facilities," the health authority of the City of Cologne states the following:

"...

Based on the legal provisions or recommendations set out above, flooring in medical practices should be designed or installed so as to ensure that reliable disinfection of the surface is possible in case of contamination.

In the case of flooring which is laid flush in plank form, it is our view that this is not ensured.

Even if any resulting joints have a width in the range of 0.1 mm, microorganisms can penetrate which can then no longer be completely removed by subsequent disinfection measures.

..."

The increasing popularity currently and over the past decade of synthetic designer flooring tiles/planks has resulted in the fact that these have become established in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc.

Due to their systems or formats (tiles/planks), the surfaces of installed/glued designer floorings have a number of joint gaps which are not heat welded or grouted.

Consequently it has been unavoidable in the past that conflict situations were discussed with decision-making health authorities/agencies, because on the one hand areas of buildings were not defined with regard to infection risk and on the other hand the general basic issue of the cleanliness and maintenance of floor surfaces in general hygiene-relevant areas was raised.

This was the original motivation for the project plan to examine and establish whether it is possible with comparatively little effort to preventatively manufacture synthetic designer flooring consisting of tiles/planks in such a way as to eliminate concerns in agreements with the relevant decision-making health authorities/agencies.

2.2**Details on the insights/
results of the project**

The project has shown that in the case of technically correct installation/gluing of synthetic designer flooring planks, cleaning fluid gets under the flooring by way of the joints of adjacent edges.

Consequently it cannot be excluded that contaminated, impure substances in liquid form infiltrate between the edges of adjacent synthetic designer flooring tiles/planks and thus seep behind/under the flooring with the result that they can no longer be reached during cleaning and/or disinfection processes.

If there are even the smallest of gaps between the tiles/planks of installed/glued synthetic designer flooring, then it is unavoidable that liquid media will infiltrate the joints and it is equally unavoidable that these will consequently seep behind/under the flooring.

If, as was done in this project plan, the synthetic designer flooring tiles/planks are coated/sealed in one working step with a suitable, 2-component polyurethane dispersion, in this case "Bona Pure", it is shown with quantity applied here (approx. 120 g/m²) that the infiltration of liquids around the joints/gaps of the synthetic designer flooring tiles/planks can be avoided.

In addition in the course of this project plan it was established that the effectiveness of the surface cleaning of synthetic designer flooring planks is significantly improved, i.e. in the sealed halves of the areas only the faintest traces of cleaning fluid residues were found on the surface, so equally accumulation of contact dirt is not to be expected to the same extent as remained on the surface of the synthetic designer flooring-tiles/planks which were not sealed.

Overall, application of a suitable, 2-component polyurethane dispersion consisting, in this case, of the product "B Pure" can be a hygiene prevention measure which fulfils the requirements for flooring surfaces/coverings in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc. and supports the requirements of the health authorities/agencies.

2.3**Final note**

With regard to the "Technical rules for biological agents; biological agents in healthcare and in welfare facilities TRBA 250," it is appropriate for compliance with the requirement, "All surfaces must be impermeable to water, easy to clean and resilient against the disinfectants and chemicals used" to apply the 2-component polyurethane dispersion "Bona Pure" professionally in two layers/coats in order to ensure the sealing of joints at the intersection of adjacent synthetic designer flooring tiles/planks.

Finally it is pointed out that the explanations and results in this Final Project Report relate exclusively to insights and findings established at on-site inspections in the course of the project to fulfil the requirements of floor surfaces/coverings in healthcare buildings, clinics, medical care centres, joint practices, individual practices, etc.

Thus far IFR Köln has fulfilled the assignment it was given.

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	IFR Richard A. Kille Head of Institute

I herewith confirm that this is a true translation of the final project report IFR- No.5704-08-2019, which was written in German language.

Bad Zwischenahn, Germany, 12th June 2020

Gunn Wasenius-Mahn

Gunn Wasenius- Mahn

vom Landgericht Hannover allgemein beeidigte Dolmetscherin und ermächtigte Übersetzerin für die englische, finnische und schwedische Sprache (Sword interpreter and certified translator for English, Finnish and Swedish / Regional Court of Hannover.)

