

# **FOLLOW-UP STUDY OF THE ENVIRONMENTAL ASPECTS OF RUBBER INFILL**

**A laboratory study (perform weathering tests) and a field  
study**

**rubber crumb from car tyres as infill on artificial turf**

Summary

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## **SUMMARY**

In 2006 and 2007, a broad-based study was conducted into the environmental impact and health risks of the use of rubber infill from recycled tyres on artificial turf. The study showed that there was no threat of any significant environmental impact or health risks, with the possible exception of the risk to the environment caused by zinc leaching from the rubber in the long term. This was the reason for a follow-up study, which was intended to answer the question of whether zinc leaching from rubber infill poses a risk to the environment in the long term.

The study was carried out by INTRON in Sittard, in association with TNO Quality Services, and was commissioned by the VACO (Tyre and Wheel Trade Association) and the Vereniging Band & Milieu (Tyre and the Environment Association) in consultation with the Ministry of Housing, Spatial Planning and the Environment (VROM) and the National Institute for Public Health and the Environment (RIVM).

### **The study**

The study was divided into two phases: a laboratory study and a field study.

In the laboratory, a lysimeter set-up in a climate chamber was used to perform weathering tests on artificial turf systems with rubber infill from car tyres. The weathering process of the rubber was accelerated in order to measure the effect of weathering on the leaching of zinc. Both shredded car tyres and shredded commercial vehicle tyres were tested for the amount of zinc that leached out of the rubber infill.

Both systems without an underlay and with a lava underlay (10 cm thick) were tested. The leaching from a system with a sand layer (40 cm thick) was calculated using an absorption coefficient for sand based on information in the literature.

The field study consisted of analysing the drainage water from six artificial turf fields to ascertain exactly how much zinc leaches out of an artificial turf field with rubber infill made from rubber crumb from car tyres.

### **Weathering tests**

In combination with high temperature, ozone is the main cause of degradation in car tyre rubber. The tests with the lysimeter showed that in a concentration of ozone 15 times higher than the outside atmosphere, the leaching of zinc increases and then remains constant.

The leaching of zinc from artificial turf with rubber infill from commercial vehicle tyres is twice as high as leaching from artificial turf with rubber infill from car tyres.

The leaching of zinc was measured in the percolation water in the lysimeter and by means of a column test of the rubber crumb weathered in the lysimeter. The data from both of these leaching methods was used to calculate the cumulative leaching of the entire artificial turf system, including lava underlays and drainage sand, and extrapolated over a period of several decades.

The horizontal dotted line in the graphs is the policy standard for the emission of zinc into the soil, which is derived from the Decree on Soil Quality.

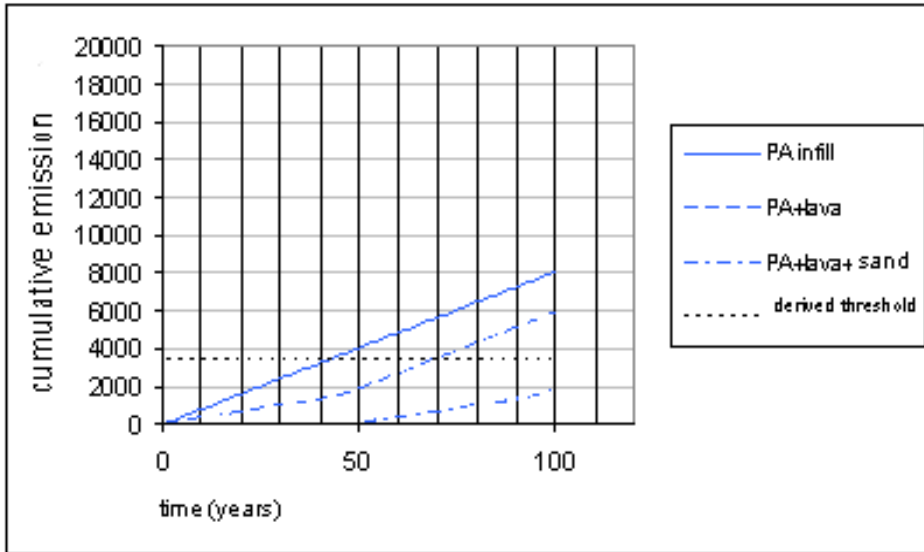


Figure 1a. Cumulative leaching of zinc from artificial turf with rubber from passenger car tyres (= PA infill), passenger car infill + artificial turf + lava and passenger car infill + artificial turf + lava + sand, calculated using data from the lysimeter.

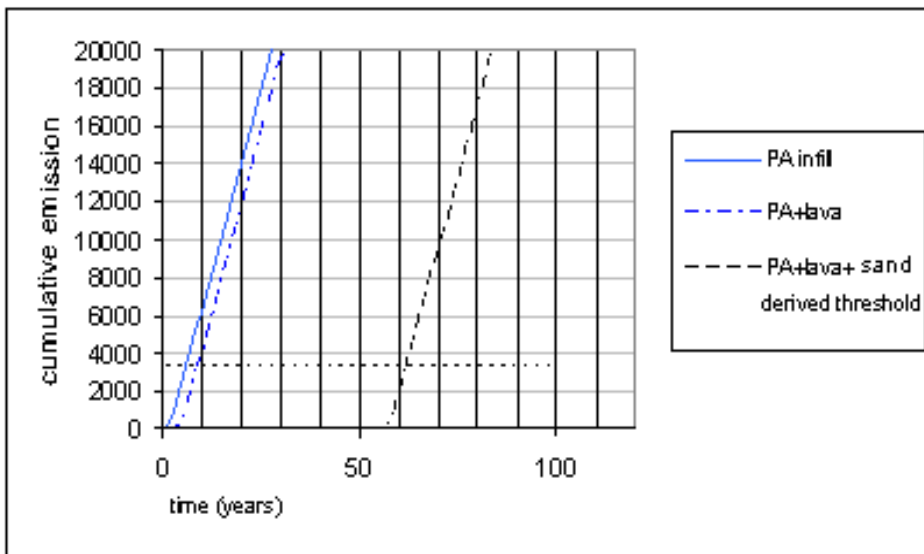


Figure 1b. Cumulative leaching of zinc from artificial turf with rubber from passenger car tyres (= PA infill), passenger car infill + artificial turf + lava and passenger car infill + artificial turf + lava + sand, calculated using data from the column test.

Conclusion of the weathering test

Figures 1a and 1b show that leaching of zinc from artificial turf systems (artificial turf field with rubber infill + lava + sand) exceeds the policy standard set for the emission of zinc from car tyre infill into the soil after 60 to >100 years. In the case of rubber from commercial vehicle tyres, this occurs a few years earlier. The bandwidth in these results depends on the test method used (column test or lysimeter test).

### **Field tests**

The field tests were performed on drainage water from five artificial turf fields from 5 to 6 years old. The fields are covered with artificial turf with rubber infill from car or commercial vehicle tyres with a lava underlay and a drainage system underneath the layer of sand. The concentration of zinc in the drainage water (an average of 0.016 mg/l) from all fields is lower than the concentration of zinc in the rainwater during the same period (an average of 0.033 mg/l). If this drainage water is discharged into the surface water, the concentration of zinc in the surface water is well below the ecotoxicological threshold value for the concentration of added dissolved zinc in surface water (MTT value). The low concentration of zinc measured in the drainage water from the fields corresponds with the calculated leaching from an artificial turf system, including underlays, on the basis of laboratory tests.

### **Zinc distribution in the system**

The concentration of zinc in the rainwater adds to the zinc that leaches from the artificial turf into the layers underneath. The total zinc load after a 10-year period of use with rubber infill made from car tyres is shown in the figure below.

[rainwater: 0.010 mg/l  
artificial turf with infill  
6800 mg/kg infill  
from artificial turf: 0.1 – 1.3 mg/l  
lava  
4 – 18 mg/kg  
from artificial turf + lava: 0.05 – 1.3 mg/l  
sand  
0.6-8.6 mg/kg  
from artificial turf + lava + sand: 0 mg/l]

Figure 2. Concentration of zinc in the various compartments of an artificial turf system and in the drainage water after 10 years.

The leaching of zinc does not lead to any significant contamination of either lava or sand underlays. Once the zinc passes through the sand layer, the concentration of dissolved zinc in the drainage water is between 0.14 and 1.3 mg/l. The bandwidth in this zinc concentration depends on the test method used (lysimeter test or column test, respectively).

### **Final conclusion**

The zinc concentration in the drainage water from 5- to 6-year-old fields is lower than the concentration in rainwater. The results of the measurements taken in the field did not exceed the standard for added dissolved zinc in surface water.

In the long term (60 to over 100 years), the leaching of zinc from an artificial turf system (artificial turf field with a lava/sand underlay) with rubber infill made from car tyres will exceed the policy standard for the emission of zinc into the soil and, after 50 to 95 years, it will also exceed the MTT for added dissolved zinc into the surface water. The leaching of zinc from the rubber infill does not result in any significant contamination of either lava or drainage sand underlays.

The impact of weathering of the rubber crumb for the technical lifetime of an artificial turf field (approx. 10 to 15 years) does not cause the leaching of zinc from the rubber crumb made

from recycled car tyres to exceed the threshold values for dissolved zinc in surface water or the derived threshold value from the Decree on Soil Quality for the emission of zinc into the soil.