EDITION 2023

VMZINC & RUNOFF
FAQ

VMZINC

VMZINC & RUNOFF

What does "runoff" from engineered structure mean?

From a material perspective, runoff is the water coming into contact with an engineered structure (e.g.transmission tower, guard rail, roof, etc.) which has the potential to liberate substance from the surface or coating and transport them away from the structure to adjacent soils, drainage systems or water bodies.

What does "zinc runoff" from zinc building product mean?

Zinc runoff from building product means zinc emission into rain waters coming into contact with building product.

What are important parameters influencing zinc runoff from building products?

Important parameters influencing zinc runoff from building products are:

- Atmospheric pollution in terms of sulphur dioxide content (the more there is sulphur dioxide the more is zinc runoff rate).
- Atmospheric chlorure content (the more there is chlorure the more is the runoff rate).
- Slope of the constructive element (the more the slope is high, the less is the zinc runoff rate)
- Surface aspect of rolled zinc.

What is the value of zinc concentration into rain waters which have passed on building products in rolled zinc?

Corrosion and runoff mechanisms of rolled zinc building applications are very well documented. This knowledge allows modelling accurately zinc emissions which may be obtained as a function of a number of parameters (atmospheric levels of sulphur dioxide and chloride, slop and orientation of the building elements and rolled zinc surface aspect).

Generally speaking, in average after 5 years of exposure under yearly precipitation of rain between 470 and 790 mm/year:

- zinc concentration of rainwater which has passed on natural rolled zinc roof is around 4 mg/L [(1)]
- zinc concentration is reduced by 30% with preweathered rolled zinc such as QUARTZ-ZINC® or ANTHRA-ZINC® [(1)].

The zinc concentration may be even lower if the rainwater has passed on coated rolled zinc such as PIGMENTO®, then zinc concentration is reduced by 95% [(2)].

So generally in all cases, zinc concentration is lower than the drinkable threshold equal to 5 mg/L when this regulatory threshold exists [(3)] because in numerous countries, there is not drinkable threshold for zinc like at the European level.

Does zinc runoff from rolled zinc roof present a risk for the environment?

Generally zinc runoff coming from rolled zinc applications used in building does not create a risk to the environment.

Indeed, zinc is naturally present into the environment and has always been used by living organisms in their growth and development making zinc the third trace elements the most important for human being (see Questions and Answers related to natural and essential characteristics of zinc).

Furthermore, when zinc is released into the environment, a large amount reacts mainly by adsorption with the other components of the environment such as organic matters or oxides (we speak about speciation) leaving a small amount available to living organisms (we speak about bioavailability). Generally, in soil, more than 90% of zinc emitted binds to soil particles, leaving only 10% of the zinc available for living organisms; in water, 70% of zinc emissions are captured into sediments [(4)].

This scientific knowledge about zinc behaviour into the environment (speciation and bioavailability) was incorporated into the risk assessment methods used for European regulations.

Anyway and in all cases, whatever type of building products, where it is proposed to evacuate rainwater directly into the environment, an environmental impact assessment must be carried out.

VMZINC & RUNOFF

Do current zinc levels at the general European level present any risk to man and the environment?

No. The European Commission launched several years ago the European Risk Assessment for Zinc and Zinc compounds in order to assess if there is a general risk for humans and the environment to manufacture and to use the whole of zinc products existing on the market (fertilisers, tyres, paints, cosmetics, building products, etc.).

Conclusions of the European Risk Assessment were that there is no regional risk for humans and the environment and that there is no need to reduce the use of zinc products on the European market [5].

Is zinc natural?

Yes, zinc is a natural component of the earth's crust and an inherent part of our environment. Zinc is present not only in rock and soil, but also in air, water and the biosphere. Plants, animals and humans contain zinc.

Minerals and metals are mostly obtained from the earth's crust. The average natural level of zinc in the earth's crust is 70 mg/kg (dry weight), ranging between 10 and 300 mg/kg (Malle 1992).

In some areas, zinc has been concentrated to much higher levels by natural geological and geochemical processes (5-15% or 50,000-150,000 mg/kg). Such concentrations, found at the earth's surface and underground, are being exploited as ore bodies.

Is zinc essential?

Yes, zinc is also an essential element that means it is absolutely indispensable for all living organisms.
For human beings, zinc is the 3rd most important oligo-element after magnesium and iron and OMS recommends zinc daily intakes of 15 mg/day for men and 12 mg/day for women.

Indeed, for human being zinc is vital for:

- Growth and cell division,
- Fertility,
- The immune system,
- Taste, smell and appetite,
- Skin, hair and nails,
- Vision,
- Etc.

Bibliographical References:

[1] "Occurrence and fate of corrosion induced zinc in runoff water from external structures", Sophia Bertling and al, Science of total environment n°367, February 2006.

[2] Umicore Building Products France internal report

[3] U.S. Environmental Protection Agency (EPA) - National Primary Drinking Water Regulation, French regulation 'Décret n° 89-3 du 3 janvier 1989 modifié (Annexe I.1) sur les limites de qualité des eaux destinées à la consommation humain » e and Danish Regulation

[4] "Atmospheric corrosion, runoff and environmental effects of zinc-based materials » I.Odnevall and Al. Workshop "Galvanizing of steel stip" Luxembourg February 27-28th, 2002

[5] European Risk Assessment for zinc and zinc compounds – CASE n° 7440-66-6 and EINECS n° 231-175-3

This case study illustrates the application of current science and methodologies described in this document and represents information collected as part of a risk assessment at a major international airport in the USA. While this summary only focuses on the contributions from zinc roofs, the overall project demonstrated a successful application of the philosophies and tools that exist for incorporating zinc bioavailability into the regulatory decision making process (Brix, 2010).

The study site was located near the Seattle–Tacoma International Airport in Washington, USA. The airport occupied over 2500 acres with stormwater draining to two principal watersheds. The storm drainage system for the airport collected stormwater runoff from approximately 1000 acres, primarily providing drainage for the runways, taxiways, terminal and cargo facility roofs, and roads near the airport. This runoff was collected in enclosed drainage systems and discharged via outfalls from 12 principal drainage areas. In addition to the stormwater drainage outfalls from the airport, the watersheds also received inputs from a State Highway and commercial and residential areas of the adjacent city. Given the complexity of the drainage system, the study sampled water and sediments from five subbasins, representing composite and discrete runoff sources. A schematic of the drainage system, specific to a subbasin collecting runoff from buildings with zinc roofs, is shown in Figure 3.

Using a storm event beginning on March 8th, 2003 (40 hour duration, ~23 mm total rainfall) as an example, the profile of zinc in runoff was traced from zinc-roofed buildings on the airport property through an adjacent retention pond, wetland and lake, prior to being discharged to a receiving stream. The concentrations profiles exhibited characteristic "first flush" dynamics at each stage of the drainage system along with expected dilution as the amount of collected rainfall increased further down the watershed (Figure 4). Notably, a second spike in zinc concentration was observed at the end of the storm event, visible in the upper drainage area, which can occur due to changes in intensity within a single storm event. Based on the specific characteristics of the buildings and local SO_2 levels (8 µg/m³), the estimated average zinc runoff concentration was approximately 3.6 mg/L. However, the maximum measured concentration was only about 1 mg/L (Figure 4), suggesting that the small retention pond significantly reduced the zinc load (Figure 3).

As a final step, measured water quality data were used to estimate Biotic Ligand Model-based water quality criteria (DeForest, 2012) for comparison with zinc concentrations throughout the drainage area. Although runoff concentrations exceeded both acute and chronic criteria values in the upper portion of the drainage area, dilution and attenuation by soil and organic material, reduced dissolved zinc concentrations to acceptable levels prior to discharge to receiving waters (Figure 4). These finding were corroborated by the environmental risk assessment performed on the site, which concluded that moderate risk was likely in the forested wetland but was negligible several hundred feet below the points of discharge (Brix, 2010). In conclusion, the available technologies for assessing runoff potential, magnitudes and risk from galvanized and zinc structures performed incredibly well when applied to a well-defined natural system.

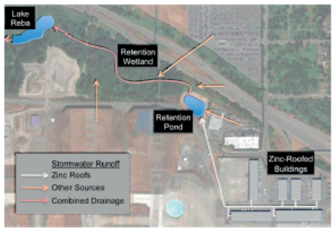

Figure 3

Conceptual flow diagram of stormwater runoff from sources at/near the Seattle-Tacoma International Airport.

Technologies for assessing runoff potential, magnitudes and risk from galvanized and zinc structures perform incredibly well when applied to a well-defined natural system.

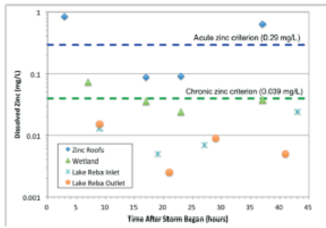

Figure 4

Dissolved zinc profiles for stormwater runoff flowing from zinc-roofed buildings through a retention wetland and lake. Minimum Biotic Ligand Model-based criteria, calculated using measured water quality data, provided for regulatory context.

VM Building Solutions USA Inc.
1513 Walnut Street, Suite 270 Cary
NC 27511
Tel :+1 919-296-8868
info@vmzinc-us.com www.vmzinc-us.com

www.vmzinc-us.com

VM BUILDING SOLUTIONS