Short summary

Pollutants can also be spread to the environment in other ways, for example through wear and tear or when using goods and products. Corrosion or the use of solvents are examples of other sources of zinc emissions (Hansson et al., 2012). Galvanizing is common to prevent corrosion on steel products. This method is widely used in Sweden on, for example, poles, handrails, downpipes etc. Zinc from goods is today a large secondary source that is very difficult to estimate (Ejhed et al., 2010) .

Metals that fall to the ground accumulate mainly in the upper parts of the soil, the marten layer which is rich in organic material. Because zinc is mobile at lower pH, it will move down the soil layer or into watercourses at a lower pH. In the marten layer , the pH is around 4 (SLU, 2017a). This causes zinc, which is a relatively mobile metal, to move down into the soil layer sequence or out to watercourses.

Zinc is included in the Swedish Marine and Water Authority's regulations on classification and environmental quality standards regarding surface water (HVMFS 2013: 19), where zinc is taken up as a particularly polluting substance in inland surface water.

The problem has shifted from point sources to diffuse sources as a result of the measures taken to reduce emissions of metals from point sources (SOU 2000: 53). This means that the contribution from diffuse sources is becoming increasingly important and is something that must be given priority. For zinc, goods that are in use and exposed to corrosion are probably a major secondary source of zinc emissions. Only when you know where you have elevated levels of zinc and where do these emissions come from can you take measures to limit the spread to the environment. The spread of metals is greatest around urban areas, zinc is around 4 times elevated around Stockholm. The levels are so high that effects on the environment cannot be ruled out.

In the future, it is expected that the oceans will become more acidic as a result of more carbon dioxide in the atmosphere and changed patterns in the catchment area and less runoff water is expected to come from the southern parts and more from the northern parts of Sweden. The water from the southern parts has a buffering property as the catchment area consists of calcareous soil, compared with the northern parts where the catchment area passes through low-calcium soils. This means that the buffering ability will be weaker (Swärd et al., 2014).

With the reduced acidification (acid precipitation), less zinc will become bioavailable and thus a smaller proportion of zinc is removed with run-off water to nearby watercourses and groundwater. But with a constantly accumulating metal content and lower leakage, the problem may be moved. With increasing amounts of zinc in the soil, the content can reach critical limits that affect land use. If land use is affected, the nutrient cycles will be slower and we will have an accumulation of organic material in the soil (SOU 2000: 53).

Metal emissions from traffic are affected by speed, acceleration, deceleration and traffic density. The zinc emissions come from zinc which is released during braking from wear of brake linings and wear of tires that contain zinc. For zinc, emissions increase with speed. Another important source of zinc emissions from traffic is road equipment and this is probably the largest source of emissions of zinc from the traffic environment. Emissions from galvanized road equipment are greater than emissions of zinc from deceleration (Hjortenkrans , 2008). Road equipment near the ground emits more zinc than other zinc-coated surfaces. This is because the ground-level zinc equipment around roads is exposed to a greater extent to corrosion (Hjortenkrans , 2008; Folkeson, 2005) and has a large surface area in relation to its weight (Sörme et al., 2001). The exposure comes from dirt from traffic and salt from winter road maintenance. Splashes from the cars make the surface damp long after the rain has stopped and thus the surface becomes more susceptible to corrosion leading to zinc emissions (Folkeson, 2005). During winter time with low temperatures and road maintenance, studies show clearly elevated levels of zinc in stormwater in environments near roads (Folkeson, 2005).

Since zinc from traffic is spread over a short distance, the design of the ditch plays a major role in how large the leakage of zinc will be. The design of the ditch, traffic volume, topography and soil conditions play a role in how much zinc will reach the recipient. How much zinc reaches the recipient also depends on how effective water purification the ditch has, if there are purification ponds nearby and how close and sensitive the recipient is. The contribution of traffic to the amount of zinc in stormwater is a significant factor. (Hjortenkrans , 2008)

A study conducted by Sörme et al (2001) has calculated the emissions of zinc from traffic in the city of Stockholm. They have estimated the use of zinc in the city of Stockholm is 28,000 tonnes. Of these, 28,000 tonnes used were 14% related to traffic. However, 49.5% of zinc emissions from the city of Stockholm are believed to be due to emissions from traffic. This means that despite the low weight percentage of zinc in traffic-related products, the use of the product produces even greater emissions. The emissions come from wear of tires and brakes, the vehicle itself which contains zinc which is released during corrosion and road equipment.

In a study done by Sörme et al (2001), it has been estimated that there are a total of 28,000 tonnes of zinc in products / goods / goods in the city of Stockholm. Of these, 33% of zinc-containing articles are in protected environments and will therefore not be exposed to corrosion. Residual articles that will be exposed to corrosion can cause emissions of zinc to the environment. The zinc comes from articles such as taps, galvanized goods and unpainted zinc roofs . Painted goods should not generate any zinc emissions (Sörme et al., 2001).

In the study done by Ejhed et al (2010), it was estimated that zinc in urban areas that reach stormwater corresponds to 97,680 kg / year in Sweden. Zinc comes from diffuse sources such as road equipment, roofs and hoods. It is not possible from this study to deduce exactly where the zinc comes from, but it is likely that some come from galvanized products, but also artificial turf and playgrounds with rubber granules as a base. In the study, Ejhed et al. Point out that diffuse emissions from goods and products are a large secondary source of emissions of metals and that emissions from products and goods are difficult to calculate.

In an urban environment, leakage from zinc-coated surfaces can be a significant source. Solutions should be discussed to reduce emissions in the future or to ensure that the pollutants do not reach sensitive recipients.

Diffuse emissions of zinc are greater to both air and water than point emissions. Diffuse emissions are difficult to estimate. Traffic and galvanized road equipment are believed to be a major source of zinc emissions. Zinc has elevated levels around major roads and urban areas where galvanized road equipment, traffic and galvanized goods are common. Artificial greens with rubber granules are also a secondary source of emissions. Because zinc is toxic at low concentrations, elevated levels in areas near roads or artificial turf can lead to damage to sensitive recipients.

Locally, surface water with elevated zinc levels in such high concentrations occurs that the recipient cannot be classified as “good chemical surface water status” regarding zinc according to the Water Framework Directive. This means that future expansions of, for example, roads, construction of artificial turf or construction of buildings with zinc-coated materials within the recipient's catchment area, risk violating the directive and therefore cannot be implemented. Locally, high levels of zinc in surface water have a potential environmental impact and the high levels affect the opportunities for expansion of certain societal functions if site-specific adaptations are not implemented.