TECHNISCHE UNIVERSITÄT WIEN
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Old Track Ballast

Recycling or Disposal?

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Problem

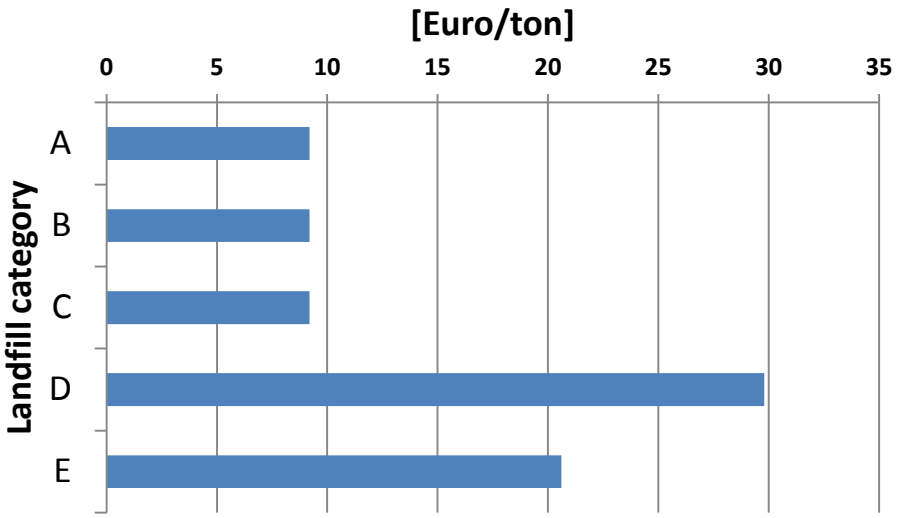
Landfill costs for

227.000 tons	ballast (non-hazardous waste)
151 tons	ballast (hazardous waste)

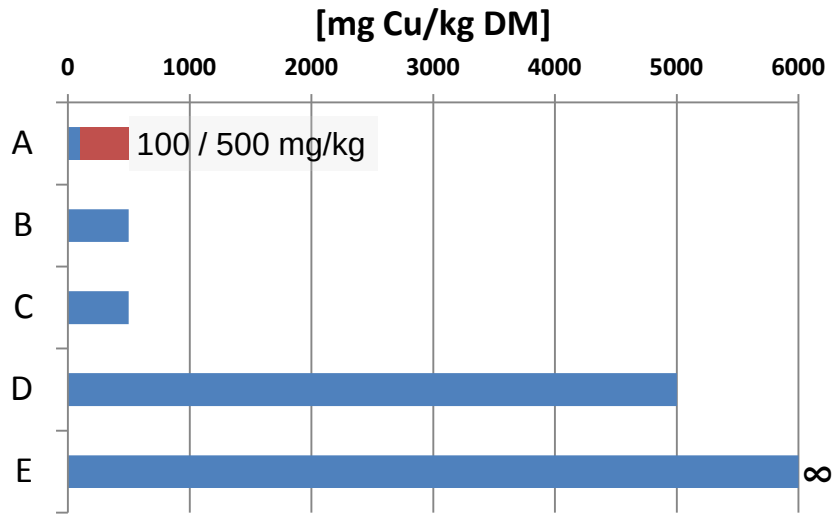
Driver: Copper concentrations

More copper, more costs

Landfill costs

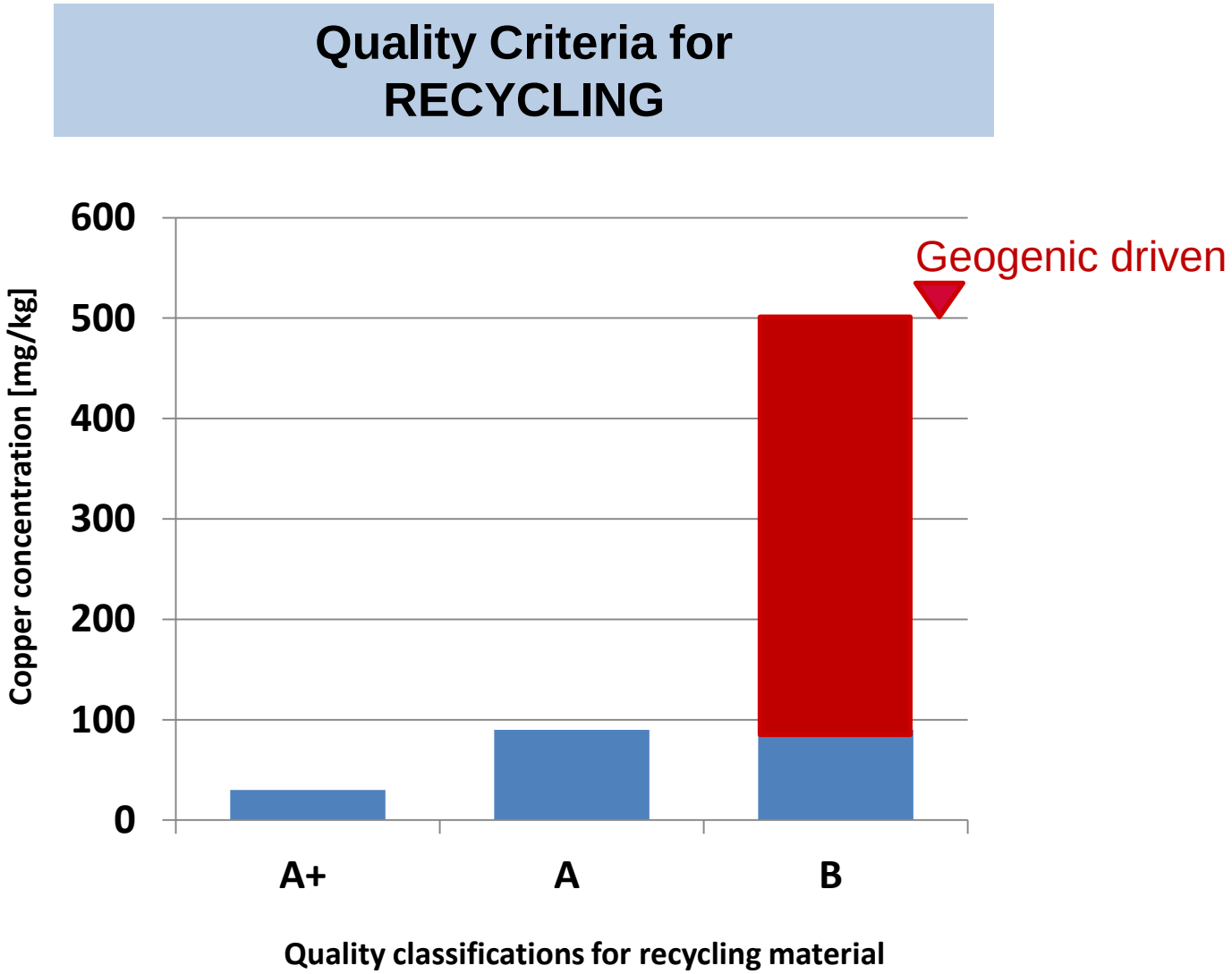


Quality criteria for landfilling



Source: Austrian Landfill Ordinance 2008; Austrian Economic Chambers

More copper, less recycling



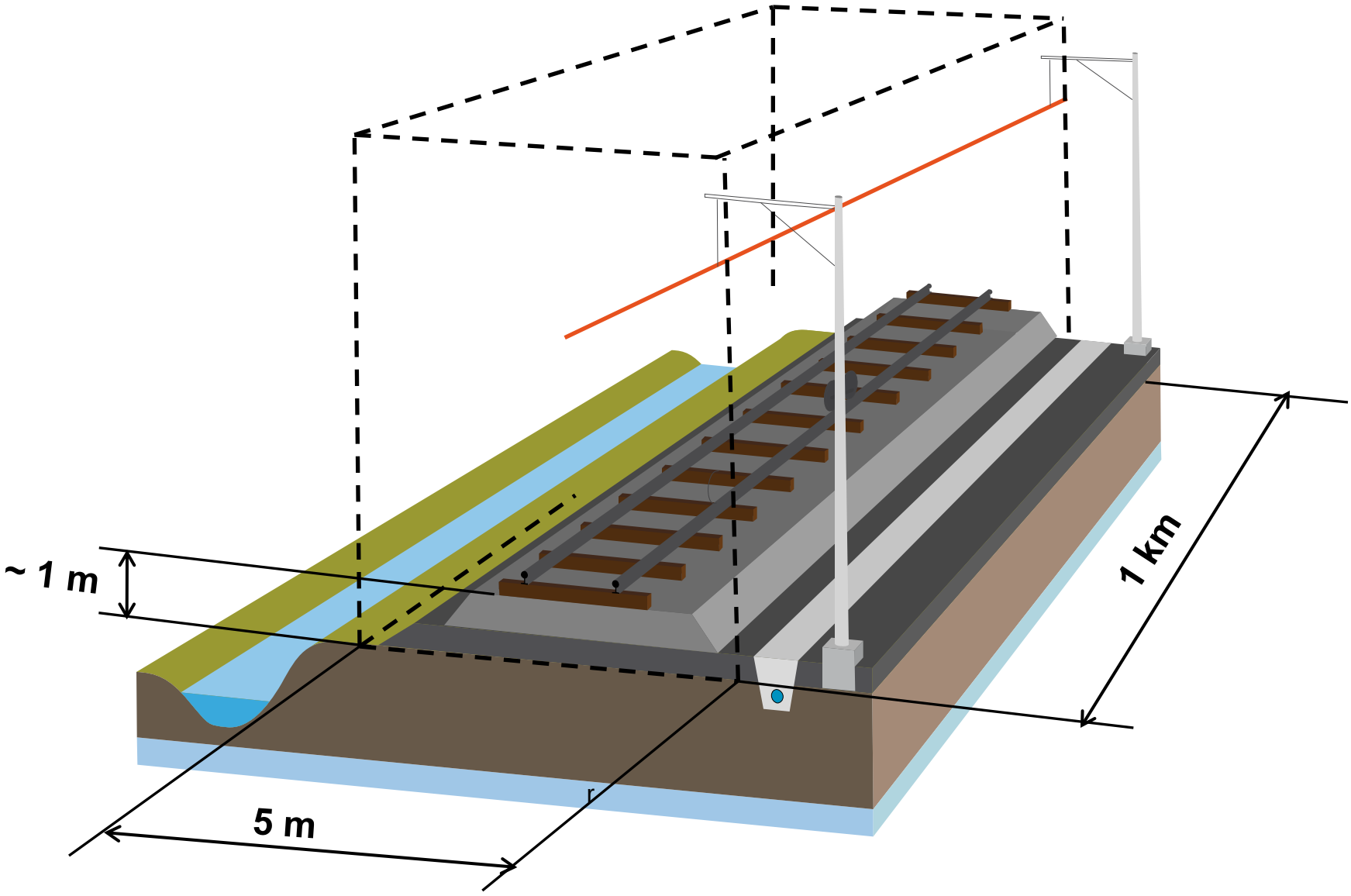
Source: Federal Waste Management Plan 2011

We need to know...

Copper sources, pathways and sinks at railroads

Geogenic / anthropogenic ratio

1km railway line



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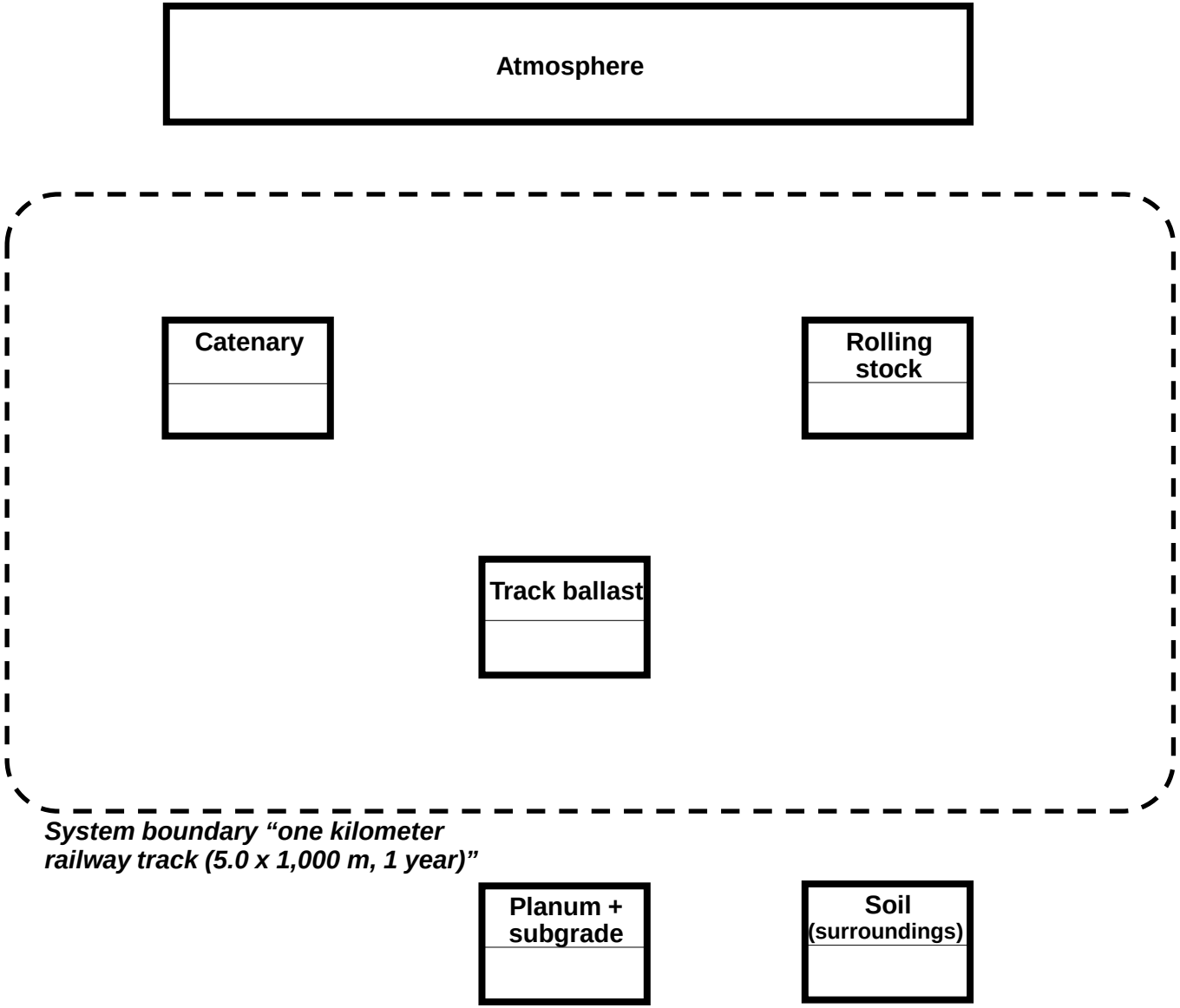
Copper flow analysis

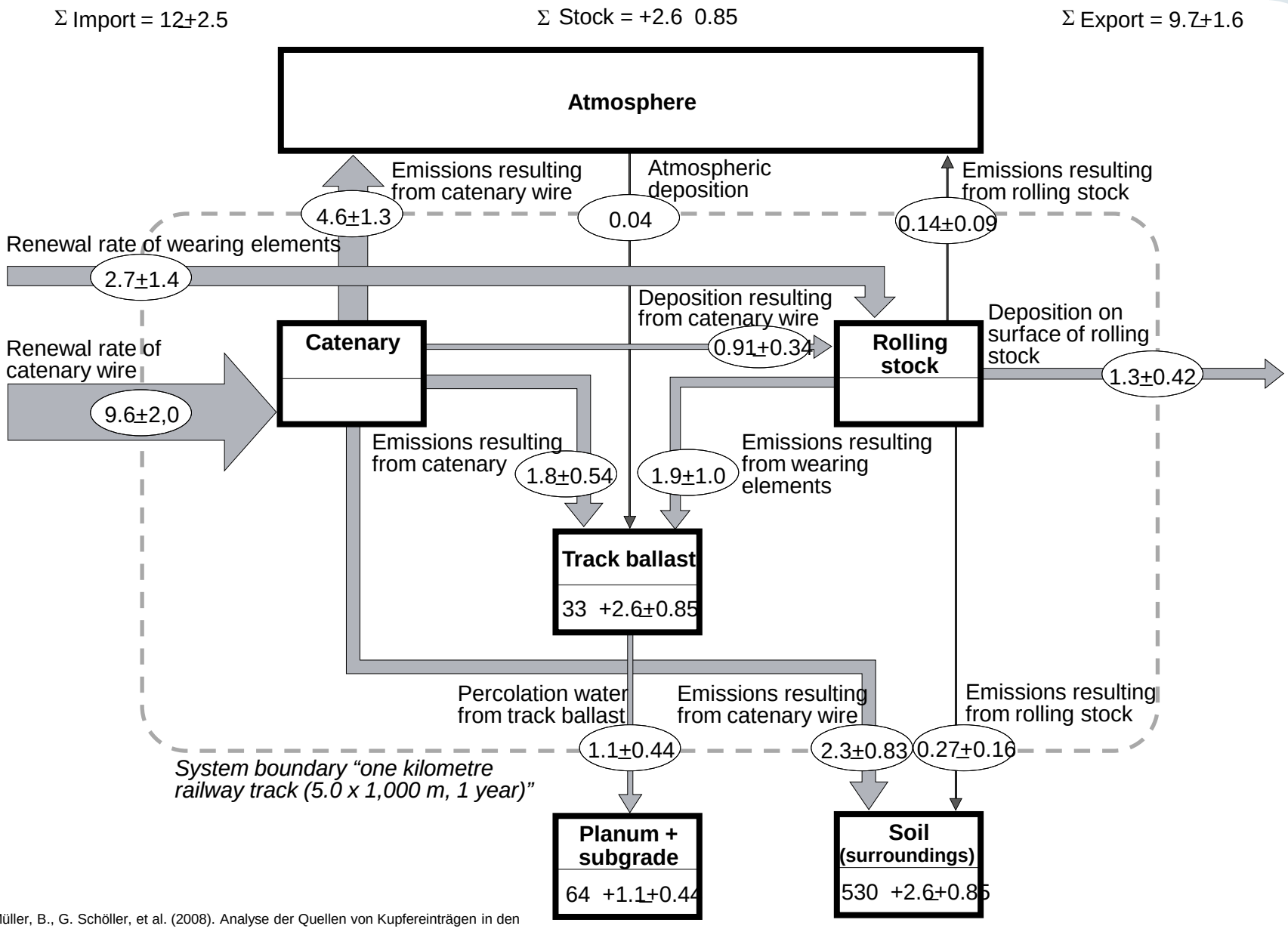


Substance flows act on site!

Bildquelle: [TU Wien (2007)]

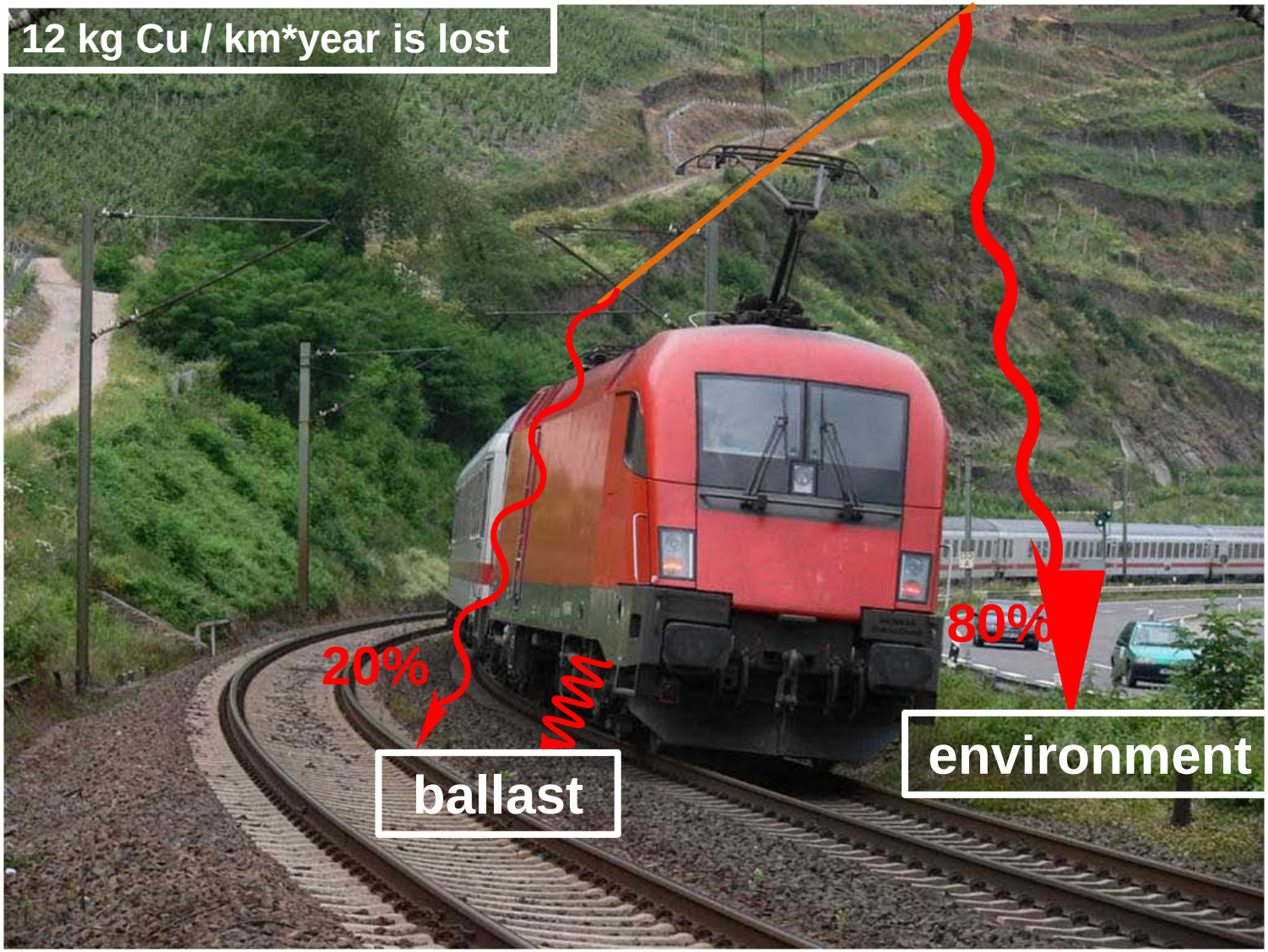
Copper flow analysis

Stocks [kg]
Flows [kg/(km.year)]

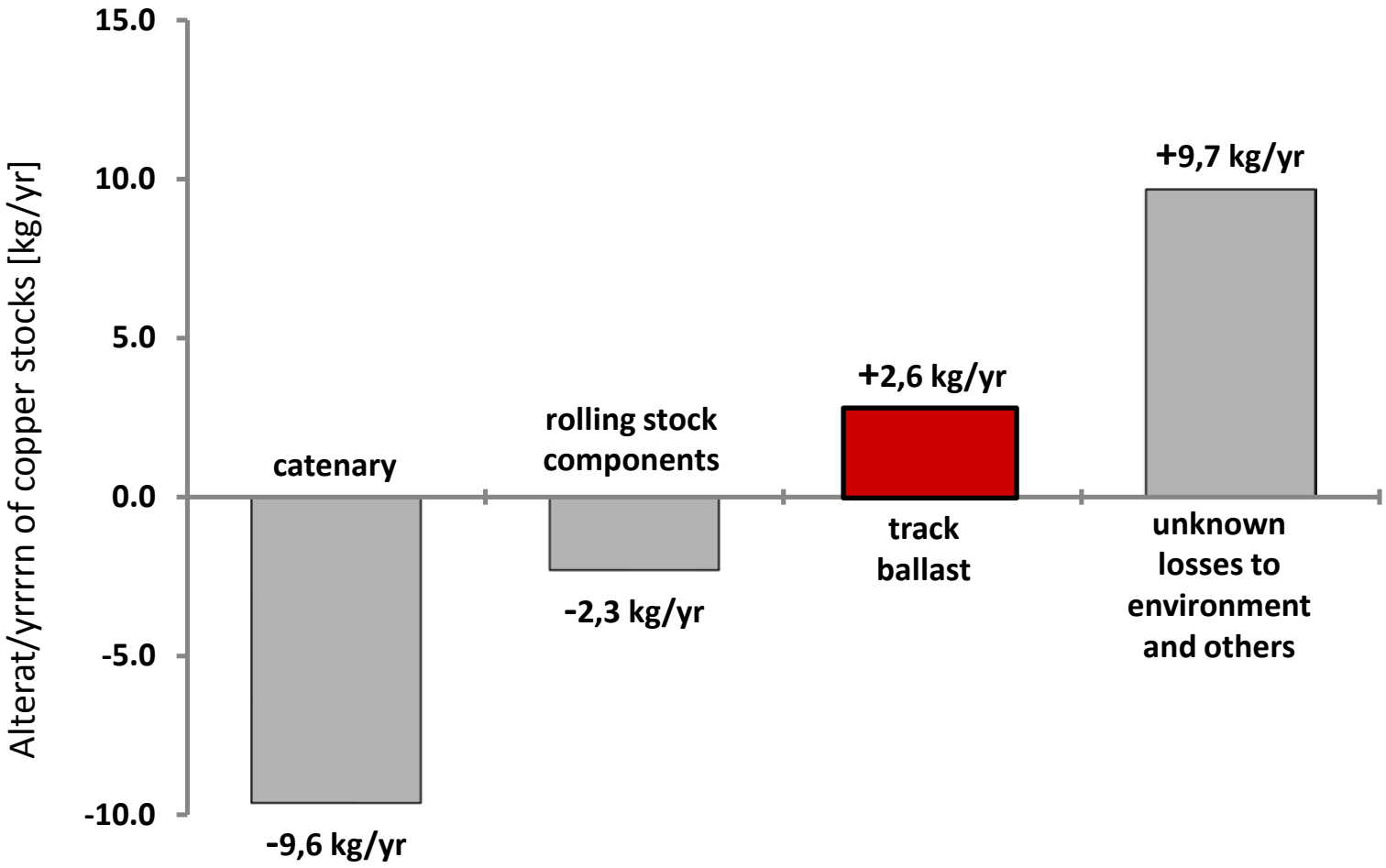


Müller, B., G. Schöller, et al. (2008). Analyse der Quellen von Kupfereinträgen in den Gleisschotter, im Auftrag der ÖBB Bau AG. Wien, Technische Universität Wien.

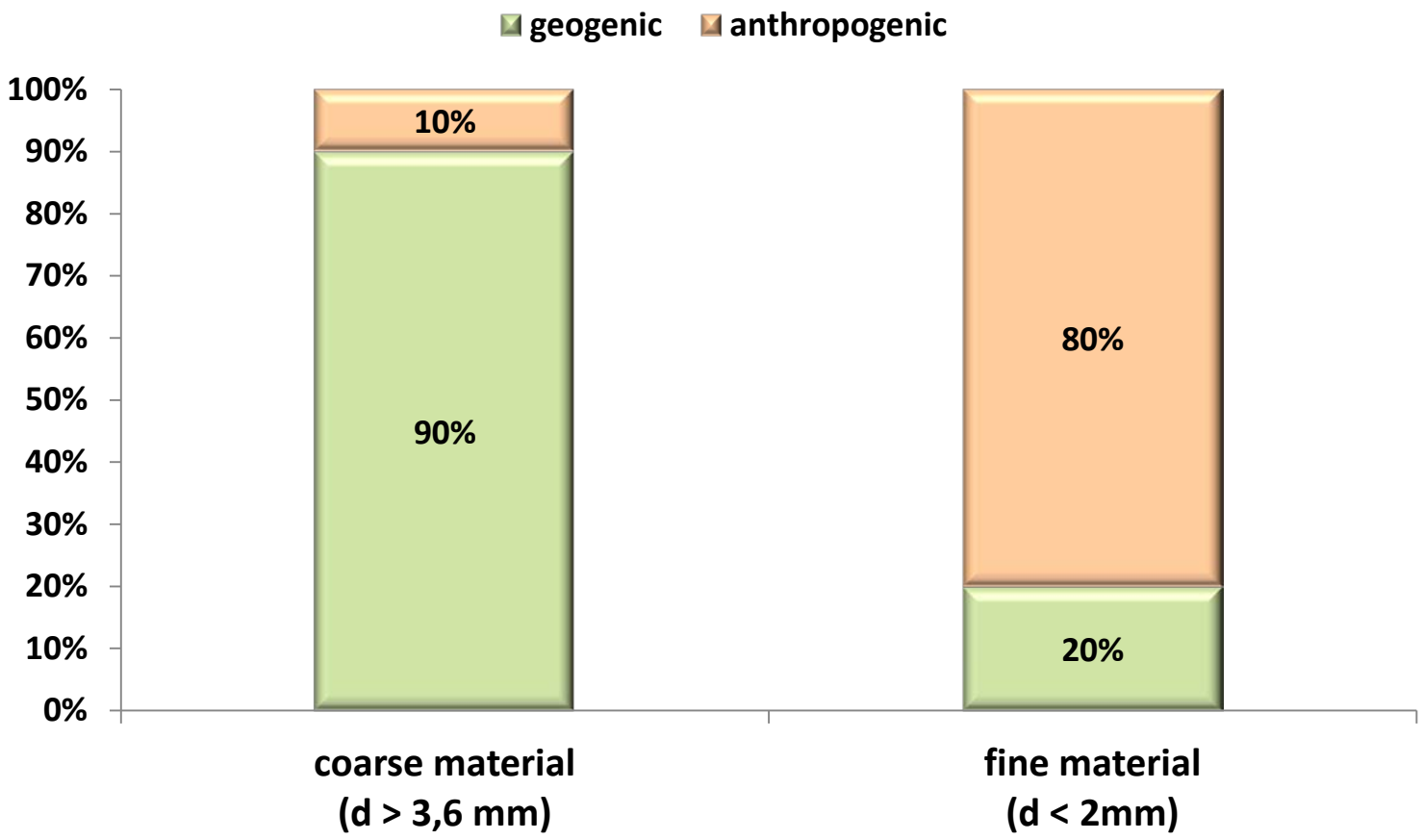
Where does the copper go to?



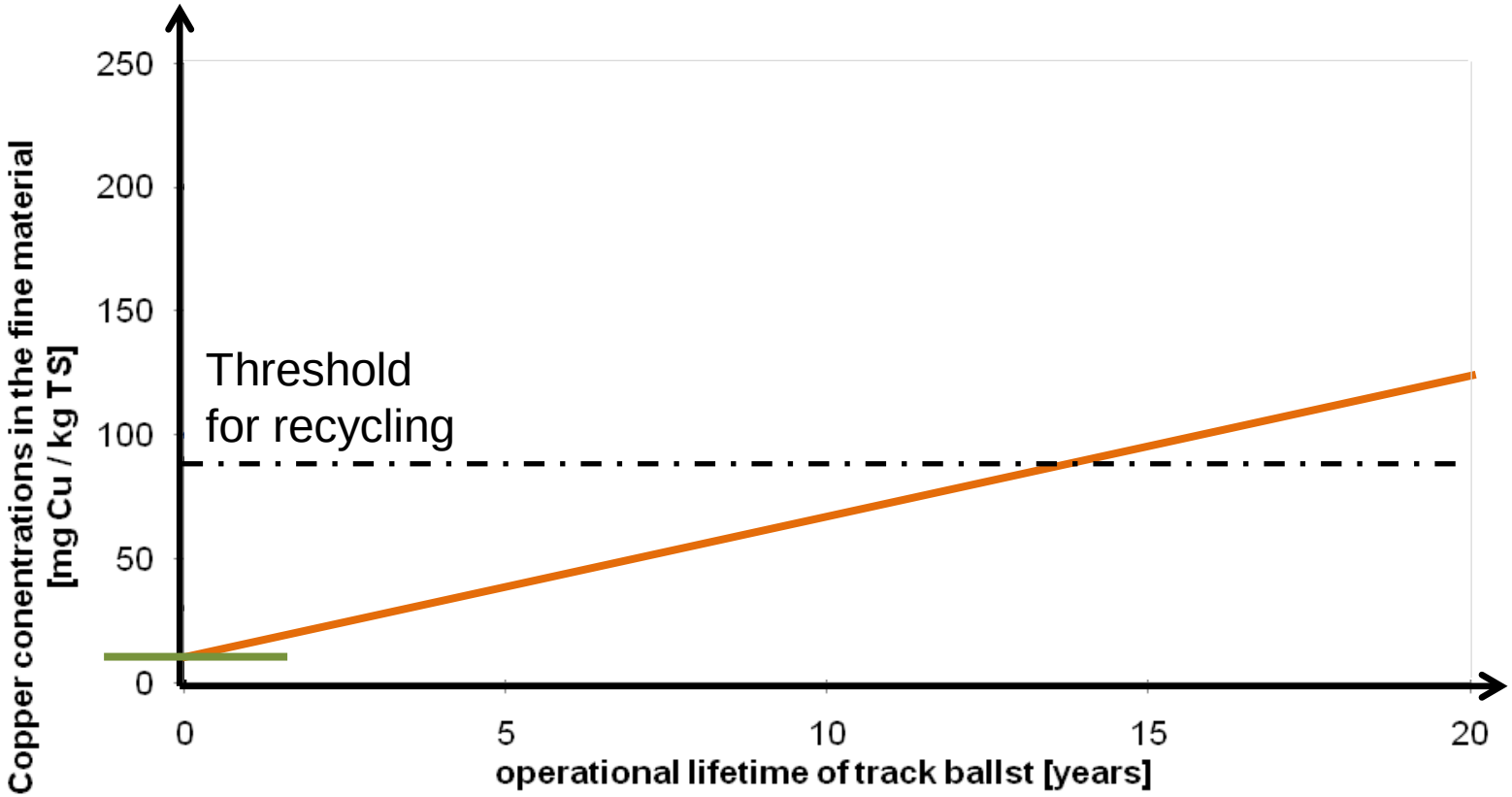
Copper losses & gains



Geogenic or anthropogenic?



Fine material, contaminated by copper



Solution 1: Avoidance of contaminants

Source oriented measures to reduce copper entries

Purchase ballast low in Cu

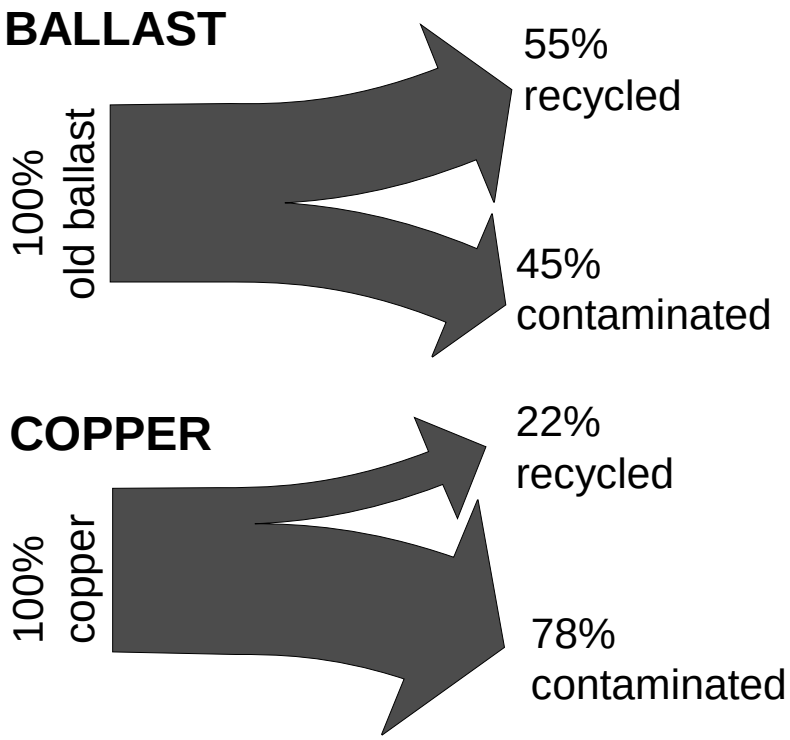
Replace copper in brake pads

New design in overhead lines

Solution 2: Separation of contaminants

Technology optimizes recycling rates

Source: http://www.ing-k.de/galleri/e.php



Summery

Costs
Landfilling instead of Recycling → Cu as driver

Emissions
~ 12 kg Cu * km^{-1} * yr^{-1}

Impacts
20% Cu enters ballast
80% Cu enters surrounding environment

Geogenic copper part
- crucial for landfilling OR recycling
- less geogenic part in fine fractions
- Landfill Ordinance & Recycling Standards lack of clarification regarding the use of the upper threshold level

Outlook

Future recycling potential
- Net-work wide analysis at “hot spots” and “virgin” railroads
- Screening all relevant parameters

Environmental impact of diffuse emissions

Discussion
- Quality criteria for recycling material

Parameter	Emissions from Operation [1] [g/km*yr]
Copper (Cu)	6.480
Nickel (Ni)	50
Chromium (Cr)	960
Arsenic (As)	?
Lead (Pb)	0,5
Cadmium (cd)	0,3
Kobald (Co)	?
Mercury (Hg)	2.750
Zinc (Zn)	50

1) Swiss Railway Network. Burkhardt, M., L. Rossi, et al. (2008). "Diffuse release of environmental hazards by railways." Desalination 226(1-3): 106-113.

Thanks for your attention!

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