

Transfer dynamics of road deicing salts in a retention pond for road water treatment

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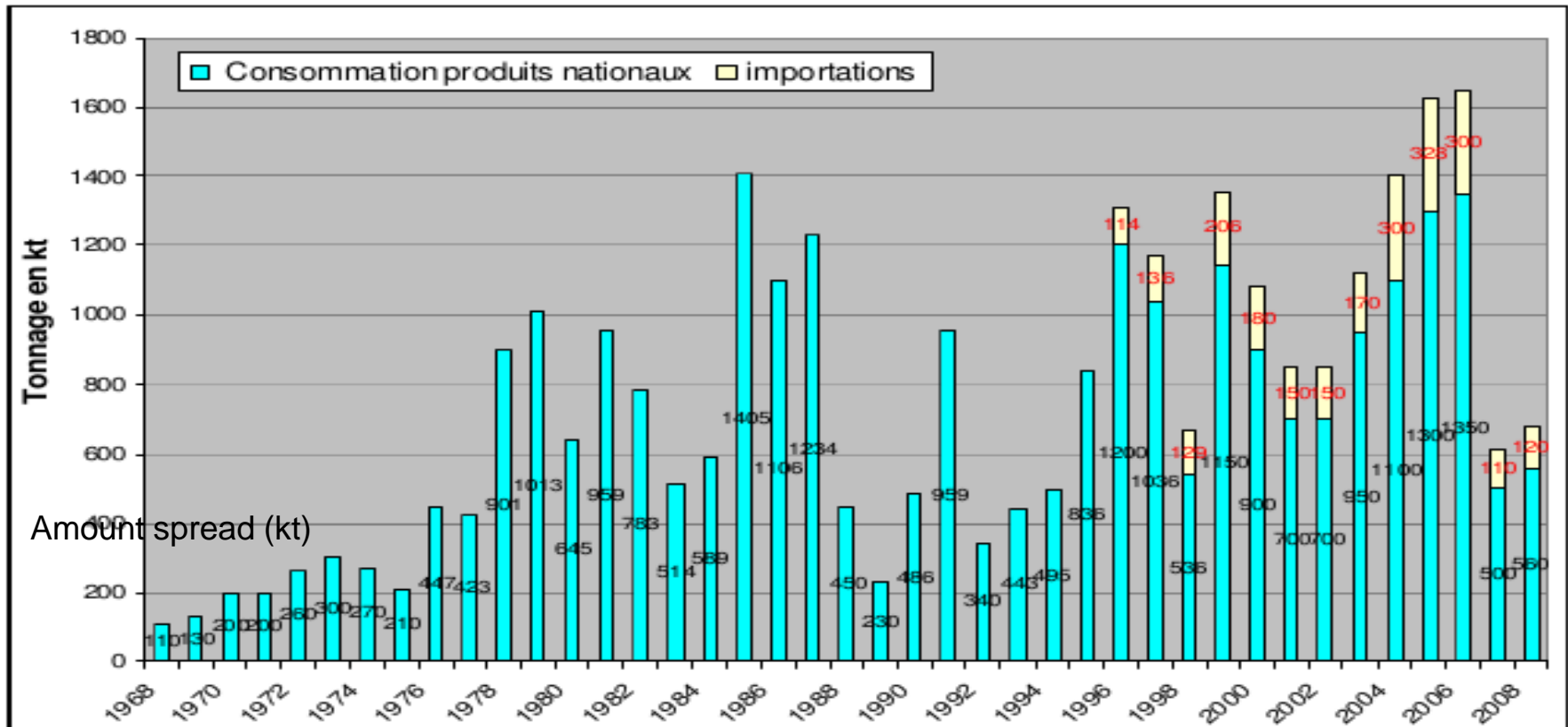


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1. Context

>Winter road management: application of NaCl on the road network



>Important increase in deicers spreading in France (200,000 tons/year in 1970, 2,000,000 in 2010 of NaCl)

1. Context

>Significant increase in Cl^- and Na^+ concentrations in water, roadside soils and organisms (correlated to deicers application)

>(Baeckstroem *et al.*, 2004 ; Pienitz *et al.*, 2006)

>Possible trace metal remobilization in road runoff retention ponds due to Na^+ and Cl^- effects on ionic exchanges and colloid stability

>(Tromp *et al.*, 2012)

>No specific treatment and no monitoring of deicer impacts and influence on road pollution in France.



2. Objectives

- > Which mechanisms are involved in deicer transfer from the road to the environment, through retention ponds?
- > Which solutions could be set up to improve treatment of deicer pollution?

↳ *Main objectives of the project*

- > **1.** Definition of the relationship between deicer spreading and NaCl quantities passing through retention ponds
- > **2.** Study of salt transfer and effects within the pond

3. Materials and Methods → Experimental site

> *The retention pond under study at Chenevieres (Lorraine, France)*



□ **Pond:**

- **2600 m²,**
- Equiped with a sand trap and an oil trap,
- Collects water from a road section of 1 km.

□ **Road:**

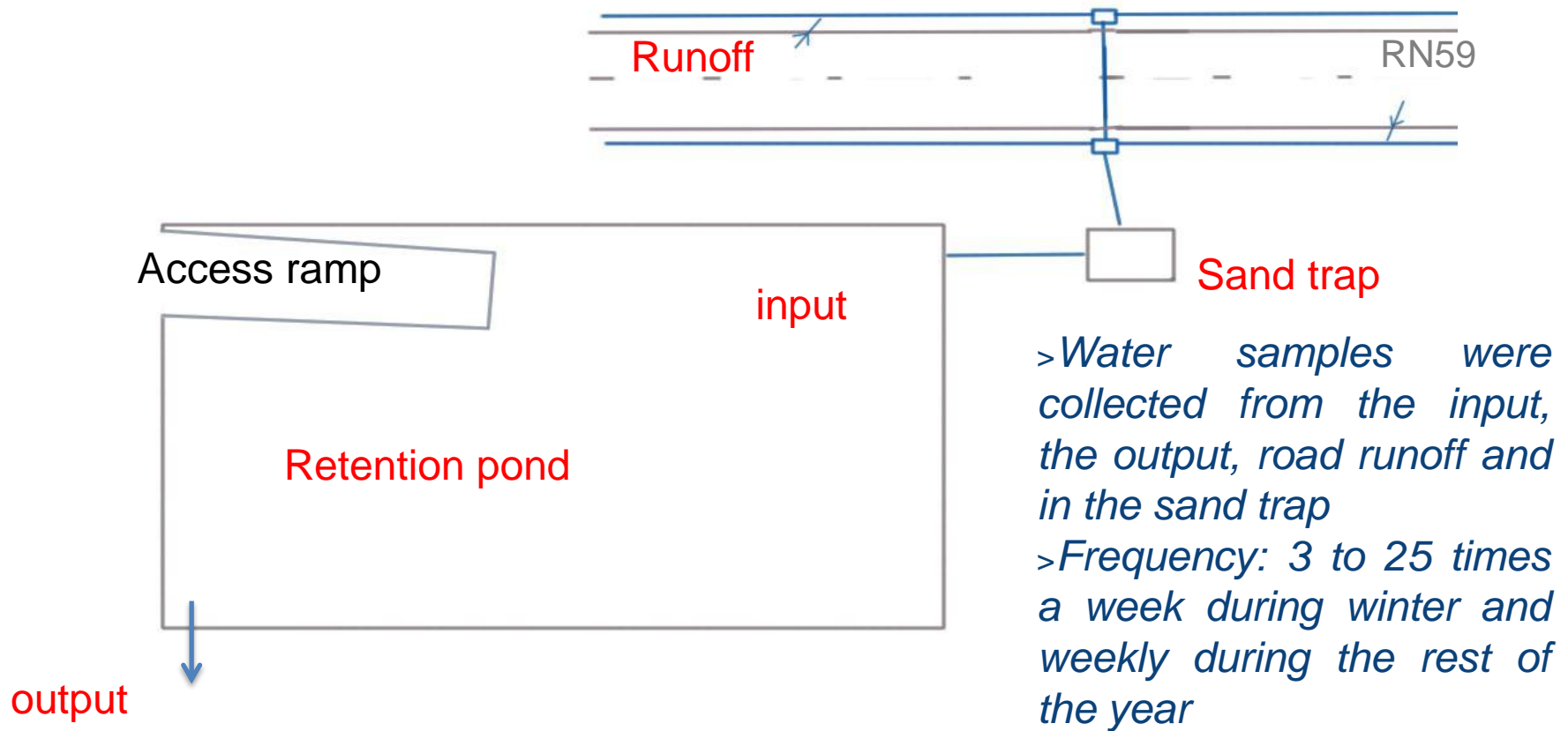
- Traffic : **10 000 veh/day,**



□ **2.7 tons** of NaCl and **250 L** of 20 % brine spread **per km** during 2011/2012 winter

3. Materials and Methods → Sampling and measurements

> *The retention pond at Chenevieres (Lorraine, France)*



3. Materials and Methods → Sampling and measurements

> Measurements and analysis

- > Conductivity, pH,
- > Na⁺ (Atomic Absorption spectroscopy - AAS) and Cl⁻ (potentiometry) concentrations,
- > Raman spectroscopy,
- > Input flow and conductivity.



AAS

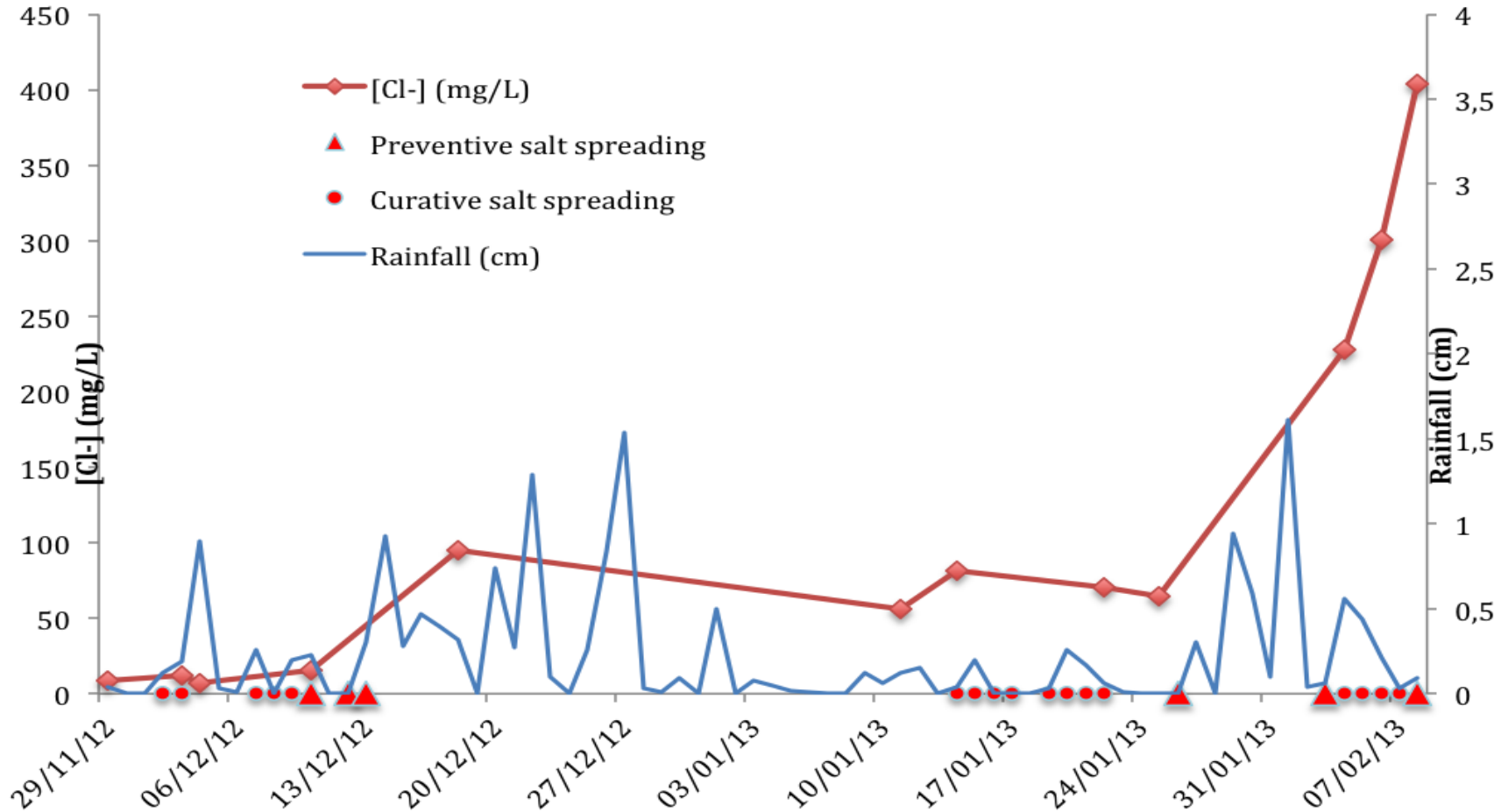
> Future measurements and analysis

- > Trace metal concentrations (ICP-AES),
- > Nitrate, phosphate and sulfates (ionic chromatography).



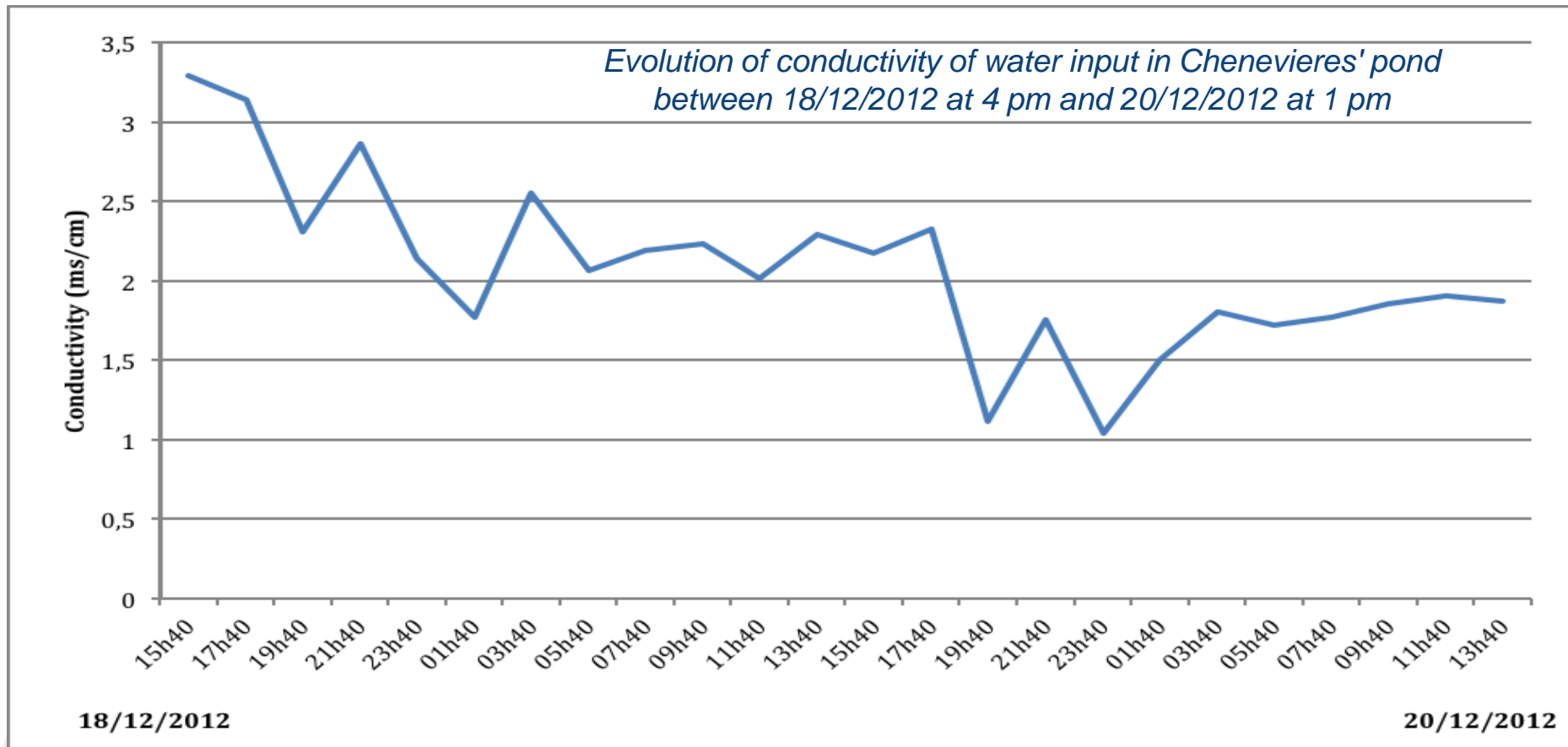
Potentiometry

4. Results



Correlation between chloride concentration and salting operations.

4. Results

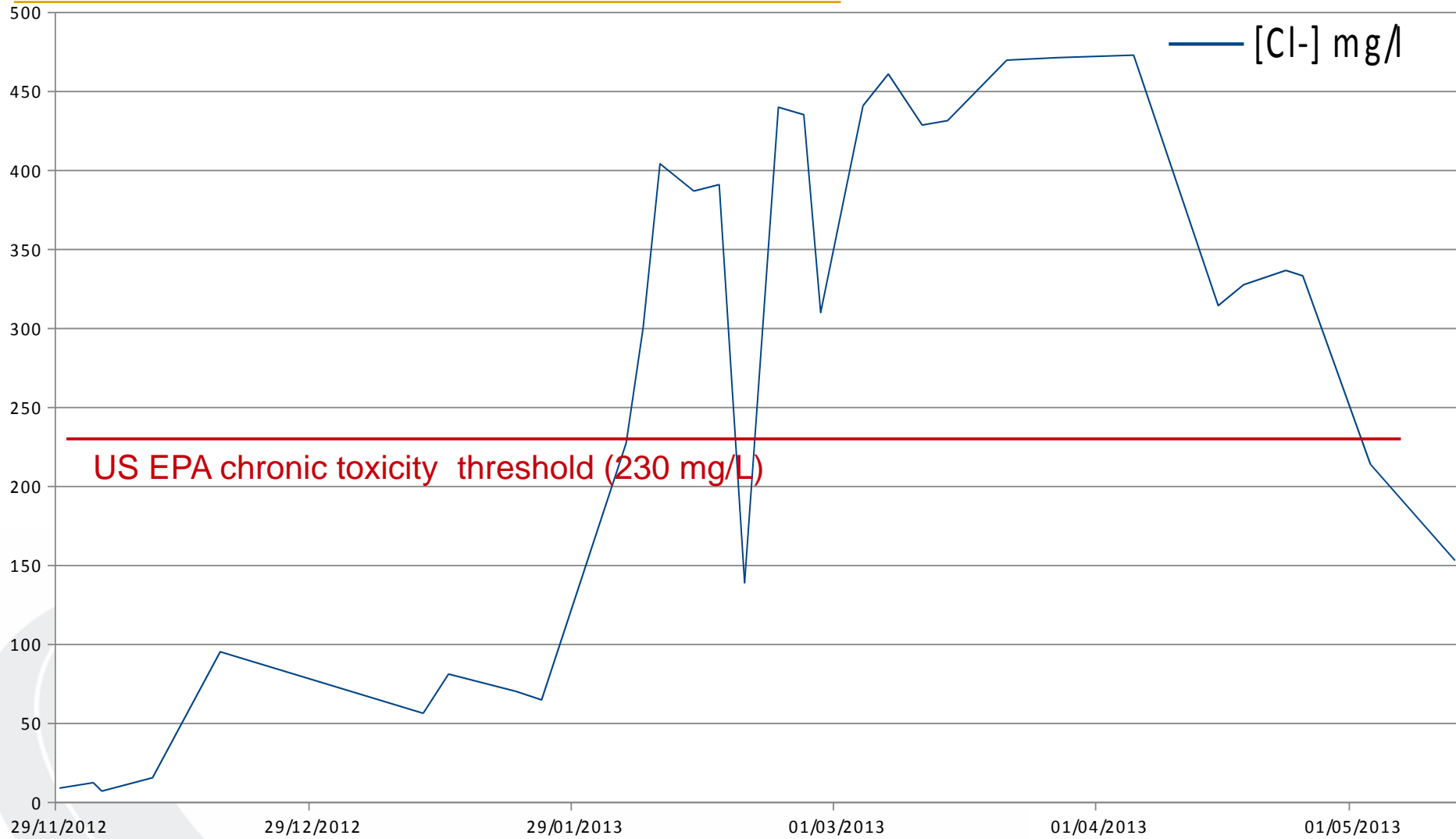


>NaCl spreading operation December the 13th and 14th

>Rainfall: 120 mm December the 16th and the 18th

>NaCl leaching: December the 17th to the 20th: delay in salt leaching from the road to the pond

4. Results



5. Conclusions

>Chloride concentration in road water runoff is frequently above US EPA acute toxicity threshold (860 mg/L)

>Cl⁻ and Na⁺ concentrations in Chenevieres pond input and output water are higher than concentrations provoking trace metals and major cation (Ca²⁺, Mg²⁺, K⁺) remobilization

>Possible synergic toxic effects of NaCl and other pollutants such as trace metals could be observed

>(Tixier et al., 2011)

5. Conclusions

- >Chloride concentration in road water runoff is frequently over USEPA acute toxicity threshold (860 mg/L)*
- >Chloride and sodium concentration in Chenevieres pond input and output water are over concentrations known for trace metals and major cation (Ca^{2+} , Mg^{2+} , K^{+}) remobilization*
- >Synergic toxic effects of NaCl and other pollutants such as trace metals could be observed*

>Further analysis and measurements required to address the deicer environmental impacts issue

6. Perspectives

- >Trace metals concentrations measurement to assess remobilization in retention ponds due to deicers*
- >Water flow measurement from input and output of the retention pond to calculate the dynamic mass balance of pollutants entering and exiting the pond.*
- >Leaching assays development in order to analyze trace metal remobilization in laboratory-controlled conditions*
- >Investigation of phytoremediation as a potential clean up technologie*

Thank you for your attention

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