DURABILITY OF BRASS AND COPPER METALS IN FINNISH DRINKING WATERS

BESTÄNDIGHET AV KOPPAR OCH MÄSSING I DRICKSVATTEN

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Nordiskt Vattenskadeseminarium 2019 28 - 30 augusti 2019 Grand Hotel, Reykjavik

Satakunnan ammattikorkeakoulu | Vesi-Instituutti WANDER
Satakunta University of Applied Sciences | WANDER Nordic Water and Materials Institute

WANDER NORDIC WATER AND MATERIALS INSTITUTE – INDOOR ENVIRONMENT

Multidisciplinary organization: Water and materials in contact with water

Focus areas:

- drinking water
- drinking water systems
- building technology
- waste water
- industrial waters
- indoor environment hygiene

Located in Rauma, Finland

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CONTENT

Brass couplings and copper pipes related problems in Finland

Drinking water quality

Legislation of water system in Finland

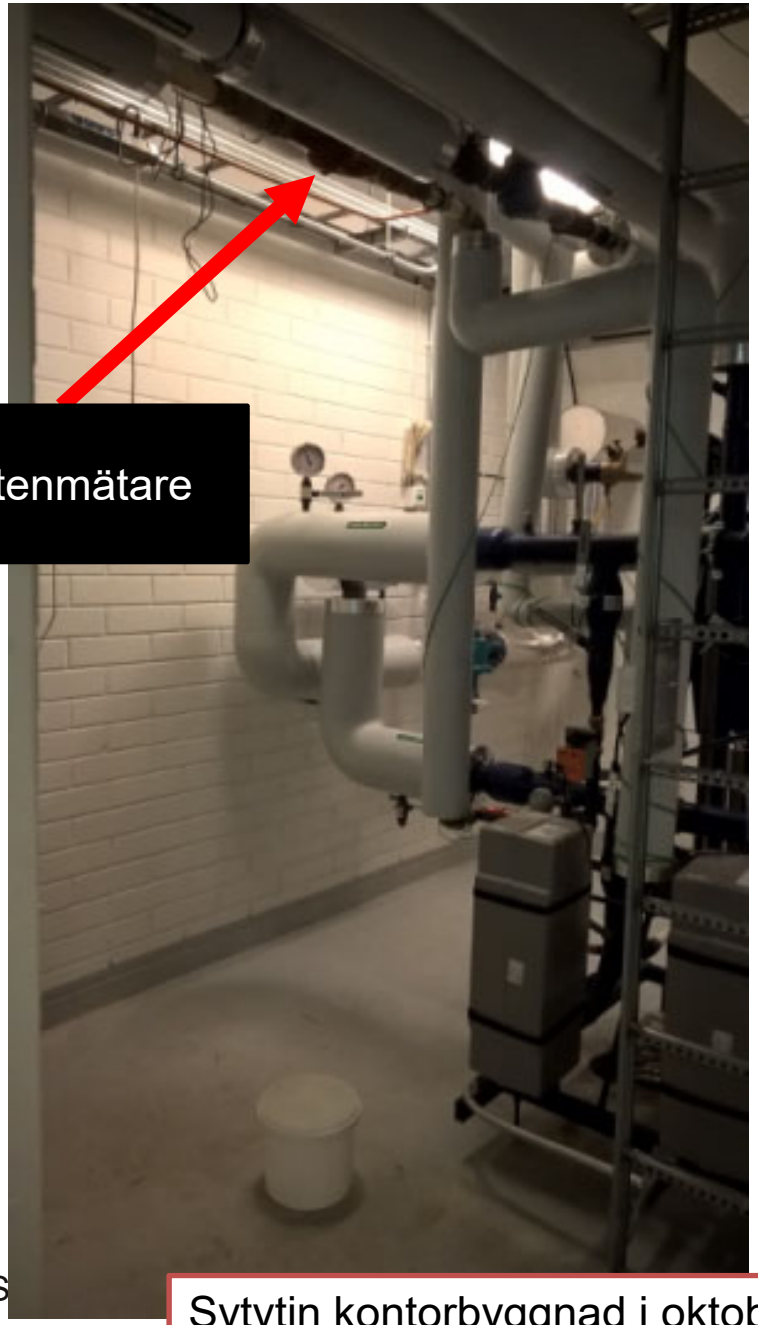
Research

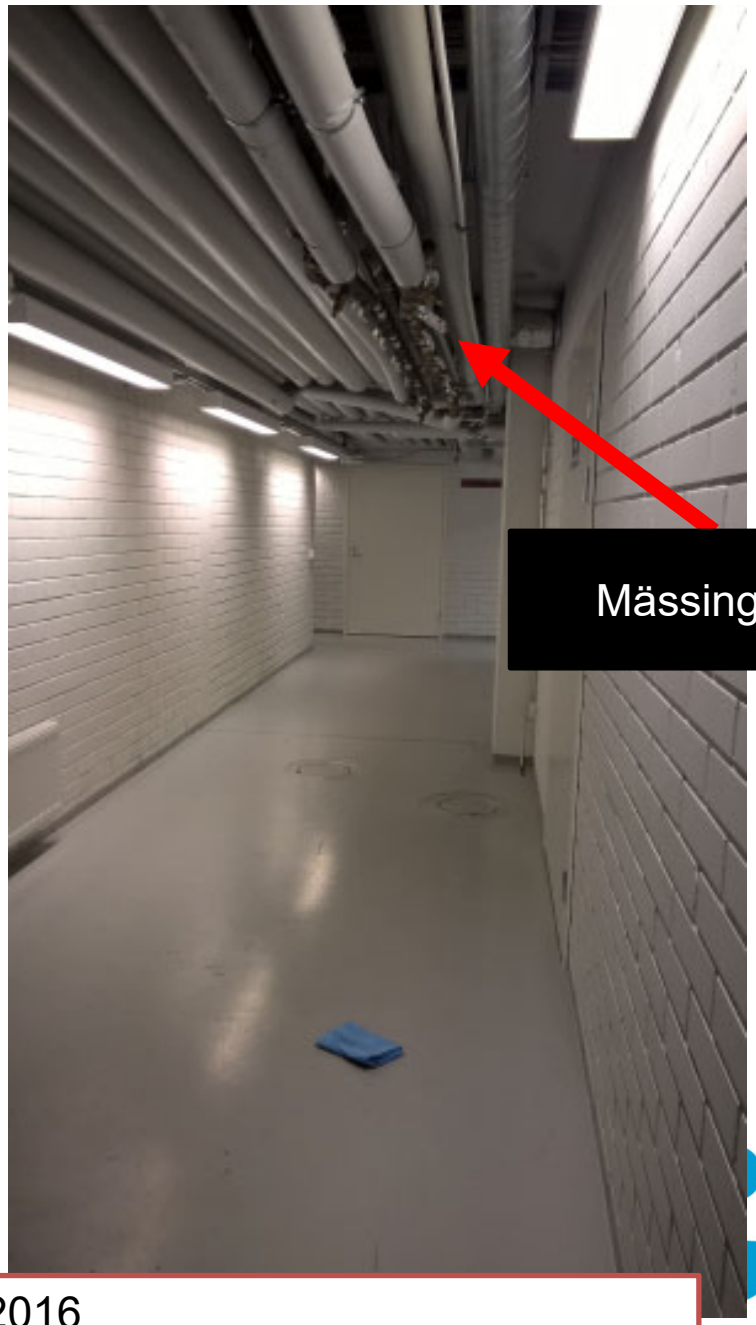
Conclusions

BRASS

Presentation about dezincification in Vattenskade-seminarium 2017

Case study in office building in Rauma. Built 2011 and first problems in brass components appeared already after 3 years use





Sytytin kontorbyggnad i oktober 2016

BRASS

The result was that there was used non-dezincification resistant CuZn40Pb2 brass

Even though

- Requirements in legislation (more information later)
- Mentioned in HVAC-plans

COPPER

Cases of pitting corrosion

Typical leaking point from outside (upper) and inside of the pipe
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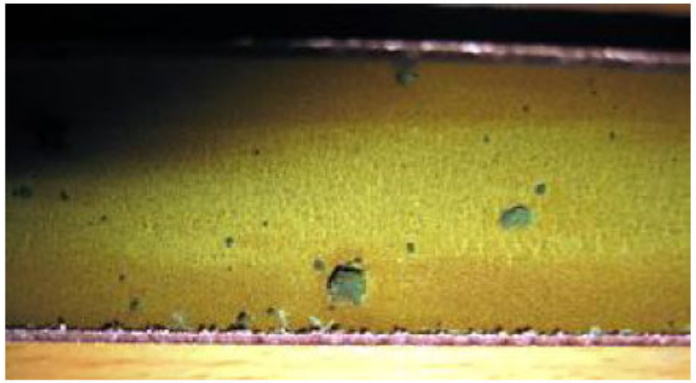
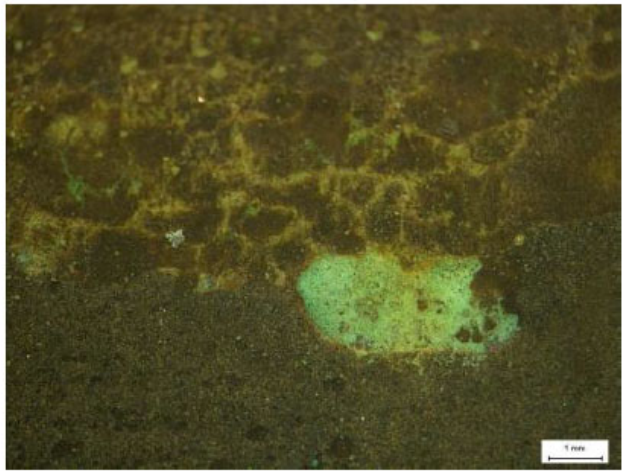
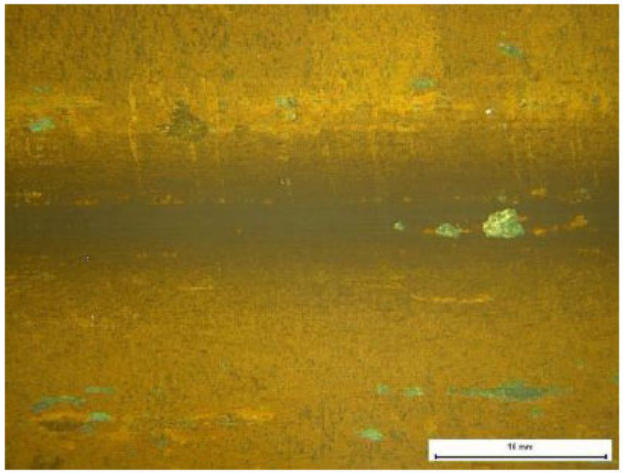
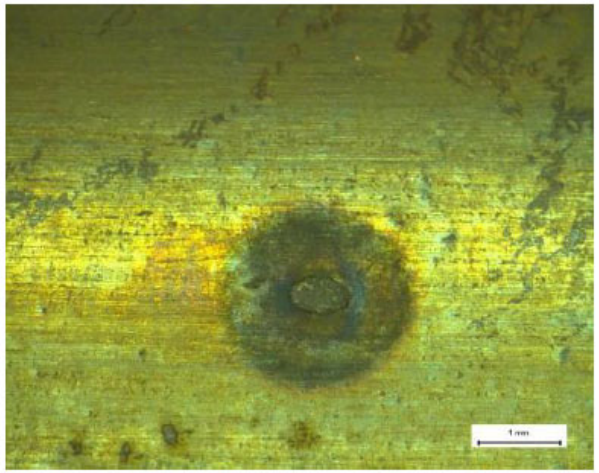




Cold water



Warm water



Circulating warm water

ESTIMATION OF DRINKING WATER QUALITY

Parameter	National drinking water legislation [1)]	SITRA´s recommendation [2)]	WANDER [3)]
pH	6,5-9,5 > 7,5	> 8,3	7,5 – 8,0
Alkalinity	> 0,6 mmol/l	> 0,6 mmol/l	> 1 mmol/l (> 60 mg/l HCO_3^-)
Calcium	> 10 mg/l		> 20 mg/l
Chloride	< 25 mg/l	< 50 mg/l	< 100 mg/l
Sulfate	< 150 mg/l	< 100 mg/l	< 100 mg/l

Silicate?

Parameter	National drinking water legislation [1)]	SCDA [4)]	Myers & Cohen 2005 [5)]
Aluminium (mg/l)	0,2	0,2	0,1
Iron (mg/l)	0,2	0,2	0,1
Manganese (mg/l)	0,05	0,1	0,03

[1)] Social- och hälsovårdsministeriets förordning om kvalitetskrav på och kontrollundersökning av hushållsvatten (1352/2015) och Valviras anvisning för tillämpning av hushållsvattenförordningen 16/2018

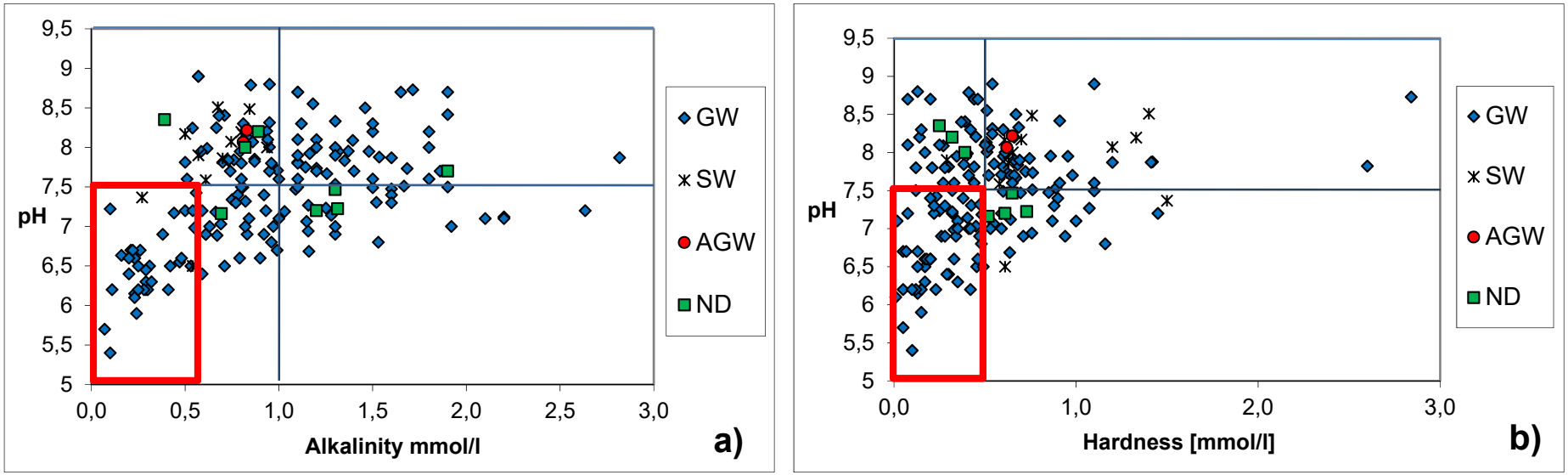
[2)]SITRA 1980. Korroosio vesilaitoksilla, vesijohtoverkossa ja kiinteistöjen käyttövesilaitteissa. Helsinki 1980, SITRA, Sarja B 55

[3)]Kekki, T., Kaunisto T., Keinänen-Toivola M.M. & Luntamo M.. 2008. Vesijohtomateriaalien vauriot ja käyttöikä Suomessa. Vesi-Instituutin julkaisuja 3, Vesi-Instituutti/Prizztech Oy. 186 s.

[4)]SCDA Rör av koppar. Scandinavian Copper Development Association.

[5)]Myers, J. & Cohen, A. 1995. Pitting Corrosion of Copper in Cold Potable Water Systems. Materials Performance October 1995, s. 60-62.

DRINKING WATER QUALITY IN FINLAND

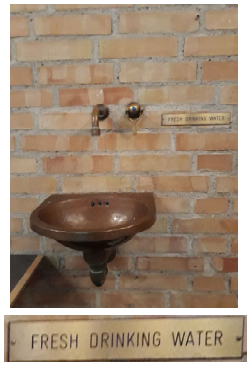


GW= groundwater, SW= surface water, AGW= artificial groundwater, ND= not detected

Ahonen M. et. al., Vesi-Instituutin julkaisuja 4, 2008

National construction product approval and product requirements in Finland

- New **decrees on essential technical requirements for products** given by Ministry of the Environment
- New **typeapproval decrees** given by Ministry of the Environment
- Most of the decrees will enter into force 1.1.2020
- Notification concerning all the decrees



- Three volantary procedures for the national approval of construction products
  1. Typeapproval
  2. Verification certificate
  3. Verification of production control
  - Possibility for verification at the construction site in certain connections

Requirements for construction products in water supply and sewage systems

- Products of metallic materials
- Products of organic materials

- Productgroups:
  - Waterpipes, valves, connections, joints, and water taps
  - Floor drains, drain pipes, connections and water seals

- Rationale for the requirements
  - Prevention of health risks
  - Prevention of water damages and corrosion
  - Ensuring usability and durability

Products of metallic materials in water supply systems in buildings

- Metallic parts that are in contact with water have to be corrosion resistant
- The brass parts that are subjected to water pressure have to be made of dezincification-resistant material (valves, connections, joints and water taps)
  - The maximum dezincification depth may not be more than 200 µm
    - The demonstration of dezincification is not required when the zinc content of the composition does not exceed 15 %
  - Because of the water quality in Finland it is very important to take notice of the dezincification-resistance to prevent corrosion.

- Copper pipes have to be made of as clean copper as possible with only a little of silver in the mix (the decree on essential technical requirements of copper pipes)

WHAT NEXT?

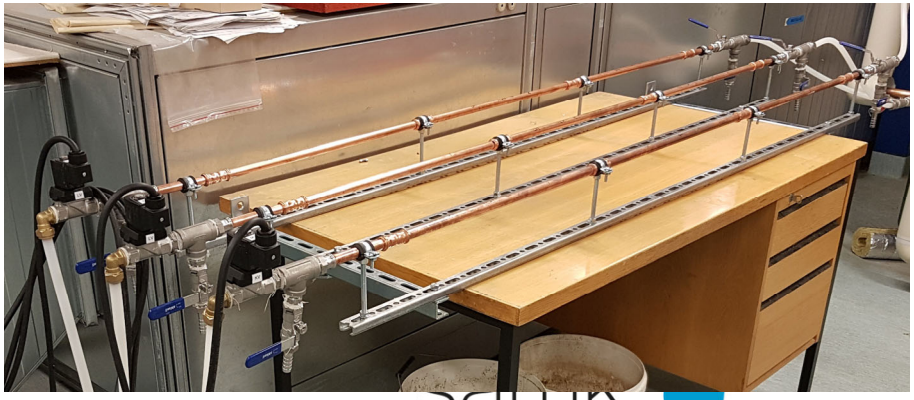
More studies are needed to gain more understanding

Questions:

- Online water quality monitoring
    - Health and/or durability
- Silicates and their impact on durability?
- Copper pitting? Why so fast?

STUDY WITH COPPER PIPES STARTED

- Started spring 2019
- Material samples after ½, 1 and 2 a use
- Hot and cold water, water samples
- Different water qualities
- Propagation of corrosion and nucleation process



DEVELOPMENT OF NEW SENSOR TECHNOLOGY

Nordic Water and Materials Institute (WANDER), together with ColloidTek Ltd. and Tampere University, is developing a method for detecting changes in water supply network quickly and economically.

The development project is funded by the Ministry of Agriculture and Forestry of Finland, and the aim is to research and develop a cost-effective method to control the quality of tap water and minimize the related risks with sensors that are attached to the water supply network. These sensors can detect problems and undesirable changes in the quality of the water right after it has been contaminated.

DEVELOPMENT OF NEW SENSOR TECHNOLOGY

The sensor and measuring technology enables monitoring the quality of liquids in real time, even outside a container, or a water pipe. The basis of the technology is measuring changes in a MHz-range radio wave pulse, and utilizing machine learning to determine those changes and the cause of the changes accurately and quickly.

This information is sent to the personnel in responsible of the water supply in real time, and they can react and minimize the harmful consequences.

The idea is that the sensor works as an alarm device when the quantity of a chemical, solid particles or microbes increases. Measuring in real time supports with controlling the risk factors related to water quality, and at the same time increases understanding of the functionality of the water processing.

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CONCLUSIONS

Dezincification is a problem already after short time of use. Main reason is water quality → Actions have been taken in development of national product approval.

Similar water quality in Finland, Sweden and Norway same challenges?

The nucleation process in copper pitting is a hot topic → Research has been started

New sensor technology is important to be able to obtain more information.