# Leaching behaviour of bottom ash with respect to pH and redox conditions

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## Introduction

Bottom ash from MSWI (*municipal solid waste incineration*) is possibly suitable as filling material in road constructions. However, its content of hazardous components, such as heavy metals, may lead to harmful effects on the environment due to mobilization of metals during usage. Much effort has been put on evaluating the risks by using lab scale leach tests. Such tests give information about what amounts could be leached from the ash during the simulated conditions, which often are related to the applied liquid-to-solid ratio (L/S). Although useful, the information given is limited since bottom ash has a very complex mineral composition and the leaching behaviour is to a large extent governed by chemical factors such as pH and redox conditions. Questions about how leaching is affected quantitatively by altered pH and redox conditions remain unanswered, but are of importance when it comes to long-term predictions, especially since incineration residues are subject to changes during time which in turn affects its chemical behaviour.

## Research questions

- How is leaching of metals affected when several factors influences the process?
- What is the expected long-term behaviour of heavy metals in bottom ash?
- Are the leach tests used today suitable for determining leaching over the long term?

## Experimental

In a two level factor designed batch test, pH and redox potential were chosen as two important factors that will affect leaching over the long term. Altered redox conditions were achieved by manipulating the availability of air during the test. Adding duration of the test as another factor makes it possible to distinguish between non-equilibrium and equilibrium conditions, thereby making it possible to use chemical computer modelling for speciation. Chemical equilibrium in lab scale tests is also a prerequisite for comparison between field data and experimental result. As a fourth factor L/S were included since the relationship between L/S and full-time scale is commonly used to interpret short-term laboratory result to long-term predictions. The complete test design is shown in the table below.

| **Factor** | + | - | **Central points** |
|---|---|---|---|
| pH | 10 | 4 | 7 |
| Atmosphere | $O_2$ | $N_2$ | $O_2/N_2$ |
| L/S *(ml/g)* | 45 | 5 | 25 |
| Time *(h)* | 72 | 6 | 39 |

As a tool in the evaluation of the results chemical speciation with PhreeqC will be used, as well as comparison with field data originated from a test road with bottom ash as filling material. This work, as well as the construction of the test road, has been performed within the Swedish BARC project *(Bottom Ash in Road Constructions)*.