

# Environmental Analytical Laboratories

## Trihalomethane Formation Potential

Trihalomethanes (THM) is a group of compounds that are formed in drinking water primarily as byproducts of chlorination of organic matter present naturally in raw water. Their main concern is health related as being possible carcinogens.

THMs normally refer to four compounds: chloroform ( $\text{CHCl}_3$ ), bromodichloromethane ( $\text{CHBrCl}_2$ ), chlorodibromomethane ( $\text{CHClBr}_2$ ), bromoform ( $\text{CHBr}_3$ ). Total THMs is the sum of all four THM compound concentrations.

The drinking water guideline for THM is 0.1 mg/L or 100  $\mu\text{g/L}$  (ppb).

The rate and degree of THM formation is a function of many parameters such as chlorine dose and residual, organic carbon concentration, temperature, reaction time, and pH.

There are rural water supplies in Saskatchewan where the THM exceeds the guideline due to the poor quality of the raw water supply. Projects have been completed and others are in progress to redesign water treatment facilities to address this issue. Pilot plant trials are required to test the efficiency of each project since the treatment design must be customized to each water source.

One very useful test to assess the level of the formation of THMs is called the THM formation potential (THM-FP). Although there is one commonly specified protocol, there can be many variations of this test. Therefore, the protocol must be specified for each project. The basic principle is to add chlorine at various dosages and measure the THMs produced under the specified conditions. This test provides much information needed for both the design and operation of a water treatment system. A total or dissolved organic carbon (TOC or DOC) test is an associated test that should be done. The THM-FP of a raw water source will indicate the maximum THMs that are likely to be produced if no treatment is used. The THM-FP test can be used during the pilot plant trials to assess the progress of the water treatment process and afterwards to monitor the efficiency of the treatment in routine operation.

The basic principle of the THM-FP is to add doses of chlorine to aliquots of the sample, allow the reaction to progress, and then measure the THMs concentrations produced using the protocol appropriate for that project.

### Variations to a protocol can be:

1. pH of the test
2. Chlorine dosages
3. Incubation periods
4. Incubation temperature

The THM formation potential is used to determine the worst case scenario. The test is performed in a closed system and thus does not mimic conditions in a flowing system. The chlorine dosages and temperatures are usually rather extreme and not typical of operating conditions. The THM-FP should provide worst case concentrations of THMs.

A THM-FP test should be done on the raw water and compared to the actual THMs to get an idea of the maximum potential concentrations. Then, during the pilot plant trials, the formation potential can be used to assess the efficiency of any changes to the system.

- THM's are byproducts of chlorination of organic material
- 4 compounds
  - chloroform
  - bromodichloromethane
  - chlorodibromomethane
  - bromoform
- Test for formation potential varies:
  - pH
  - chlorine dosage
  - incubation period
  - temperature
- Test provides worst-case scenario



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## CONTACT

Environmental Analytical Laboratories  
Saskatchewan Research Council  
422 Downey Road  
Saskatoon, SK, Canada, S7N 4N1  
T: 306-933-6932  
T: 1-800-240-8808 (Toll Free)  
F: 306-933-7922  
E: [analytical@src.sk.ca](mailto:analytical@src.sk.ca)

[www.src.sk.ca](http://www.src.sk.ca)