

# Water Analysis

## -- Supporting Stable Production



### Summary

Some amount of water is often co-produced from petroleum wells. Although co-produced water does not usually have commercial value, a great deal of information regarding the petroleum reservoir, which is needed for exploration and production, can be derived from analytical data from this water.

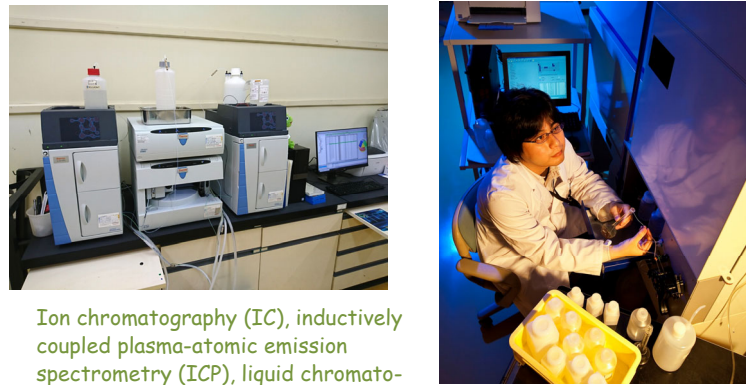
In addition to waters co-produced from wells, spring waters collected during geological field surveys, geothermal waters, plant waste waters, and river waters collected for environmental surveying are analyzed and studied for reservoir evaluation and troubleshooting during operation.

### Preparation and Wet Analysis



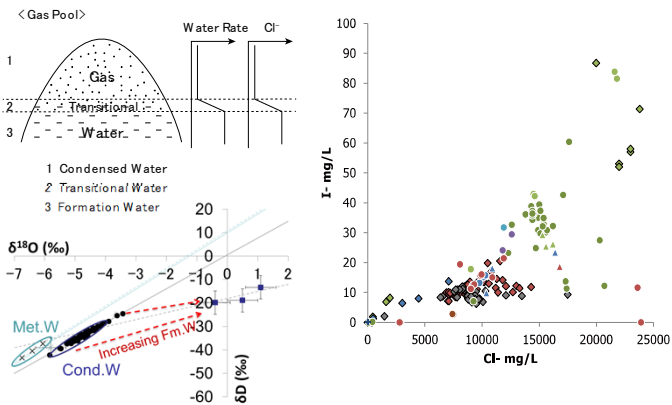
Before wet or instrumental analyses are performed, some contaminated samples are pretreated. In the field where no electricity is available, or in cases of urgency, qualitative and quantitative wet analyses are conducted based on color changes and amounts of reagents consumed.

### Analyses by Instruments (IC, ICP, LC, IRMS)



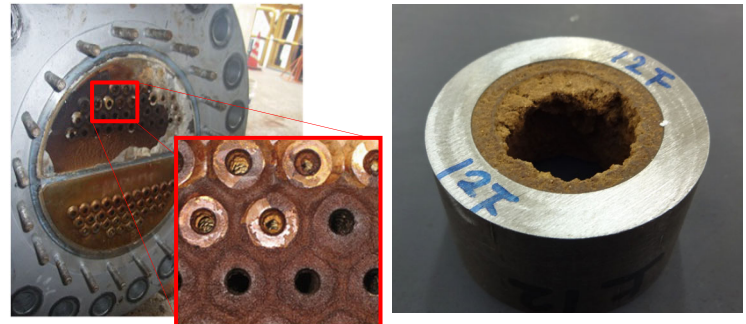
Ion chromatography (IC), inductively coupled plasma-atomic emission spectrometry (ICP), liquid chromatography (LC), and isotope ratio mass spectrometry (IRMS) are used to analyze dissolved ions, trace elements, organic acids, and isotopic ratios, respectively. These instrumental analyses have higher precision and efficiency than the wet analyses.

### Types of Water Co-produced with Oil and Gas



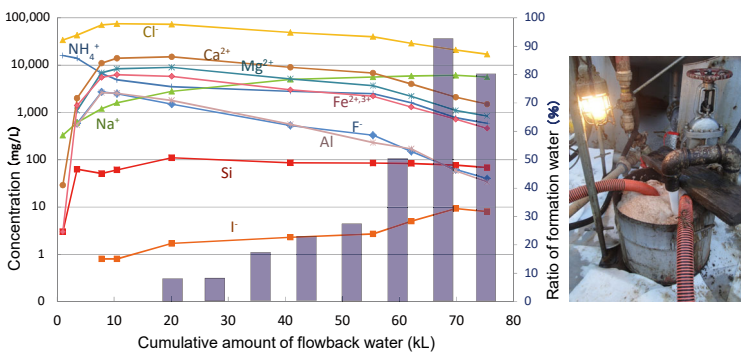
Two types of water — condensed water and formation water — are produced from wells. Formation water becomes dominant as productivity decreases. The ionic and isotopic compositions of these waters differ; therefore, these data can be used to estimate productivity changes.

### Evaluation for Risk Management of Scaling



Produced waters and waste waters experience various changes in temperature and pressure. Such changes cause the precipitation of minerals (scale), and these minerals can clog tubing in wells or pipes in facilities. Water analysis provides a solution for scale problems through estimating the amounts of mineral precipitates.

### Evaluating the Effects of Stimulation



Acidizing is a stimulation method for low-productivity wells. Various reservoir properties, such as the recovery rate of injection fluids, the types and amounts of minerals dissolved during acidization, and the production rate of formation water, can be obtained. From these data, the effects of stimulation and changes in reservoir conditions can be evaluated.



### Key Points

Water chemistry data obtained from wet analyses and instrumental analyses are used for many purposes, as described below:

- (1) To understand the status of a reservoir for field development and production operation
- (2) To reduce and resolve problems during operation
- (3) To explore new energy sources such as geothermal energy
- (4) To assess the environmental impact of exploration

Water analysis can contribute to many industrial projects such as petroleum exploration, geothermal exploration, and environmental assessment.