

WATER QUALITY FOR INJECTION SPECIFICATION

Large quantities of water are required in water injection schemes and cost-effective systems for supply depend on selecting a local source which does not involve excessive treatment costs.

Underground water sources are attractive but rarely sufficiently prolific. Lake, river or sea waters are often available in sufficient quantity, but treatment costs may put a constraint on source selection.



WHY DOES WATER QUALITY MATTER?

The water quality needs to be controlled to avoid blocking the reservoir pores, so it is critical to undertake sampling and analysis of both the reservoir material as well as the potential source waters. As this will provide a basis for selection of a source that forms the foundation for the design of a water treatment system.

It is important to use the data from the sampling of the various source water options, with the water injection quality parameters, so the system designer can set the performance requirements essential for running the plant efficiently.



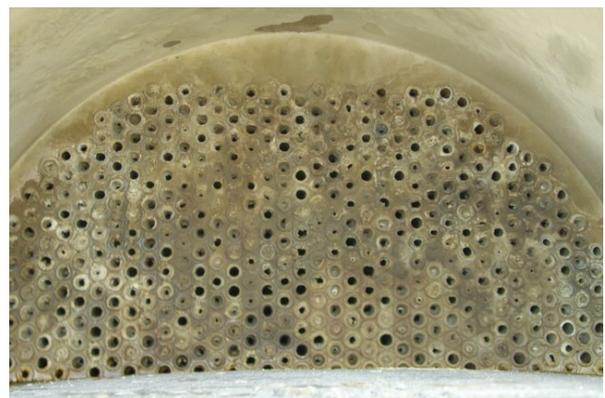
THE IMPORTANCE OF SOURCE WATER COMPATIBILITY

The compatibility of the various waters that are used within a water injection system needs to be carefully considered.

- ❖ Will produced water, or aquifer water, self-scale when being brought to the surface?
- ❖ Will scaling occur if produced water is commingled with sea, aquifer, lake or river water prior to injection?
- ❖ Will the commingled injection water self-scale during injection?
- ❖ Will the injection water scale when commingling with the formation water?

CONSEQUENCES OF POOR WATER QUALITY

Scale formation can be a costly issue, both in terms of down-time and equipment replacement, as well as ensuring compliance with local regulations and environmental legislation.



Oil Plus offers a variety of analytical services and can provide recommendations based on the data produced.

The prediction of scale formation is undertaken using software, Oil Plus uses software packages such as ScaleChem© and Geochemists Workbench© to determine the scaling tendency and potential volume of scale production under a variety of operating conditions.

ScaleChem© has been developed specifically for the modelling of scaling with oilfield waters. The program has advanced the prediction accuracy for sulphate and carbonate scales, and takes into consideration a range of factors governing scale precipitation behaviour such as temperature, pressure, activity coefficients, thermodynamics, common ion and ion pair effects, varying pH, and in some cases, the influence of oil and gas compositions, GWR and OWR.

The simulations will indicate the following.

- ❖ Prediction of the scaling species at the full range of water mixtures (0–100%).
- ❖ Prediction of scaling tendencies and scale quantities (for each scale species).
- ❖ Effect of temperature and pressure.
- ❖ Worst case water ratio as a basis for further studies.

The modelling results can be confirmed in OPL laboratories with both static and dynamic tests, and finally all the observations are matched to the actual field observations of scaling issues. This data can then be used to provide a mitigation strategy for the system.

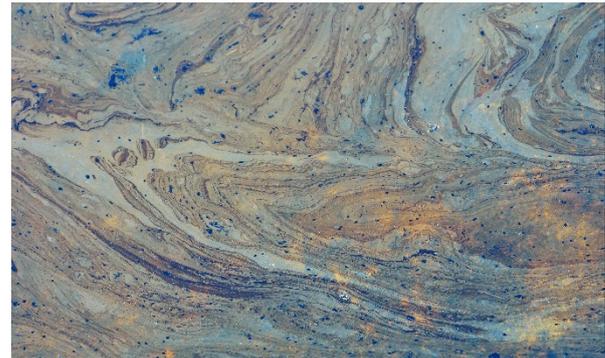
Formation damage problems in oilfield wells (producers, injection wells and disposal wells) are common in the oil industry and can be very costly to solve.

An 'up-front' understanding of the mechanisms that cause the damage, allied to evidence that shows exactly where the damage occurs, is essential before any remedial measures can be considered. Simply resorting to hydraulic fracturing, acidising or a combination of these is not necessarily the answer to such problems, and sometimes is not technically possible.

ROOT CAUSE UNDERSTANDING THROUGH ON-SITE PROCESS AUDITS

Poor performance of water treatment systems can lead to process bottlenecks, non-conformance with legislation and risk of routine operations, seriously impacting upon the local environment. All these issues result in economic implications for an operator.

Maintaining or improving the performance of existing water injection systems can help sustain, or in some cases, increase current production, reduce OPEX as well as improve system efficiency.



Full production system audits are recommended to establish the root cause of operational problems. These can include any, or all, of the following:

- ❖ Bacterial contamination.
- ❖ Corrosion control.
- ❖ Fluids characterisation, treatment and conditioning.
- ❖ Gas characterization, treatment and conditioning.
- ❖ Identification of emulsion stabilising agents.
- ❖ Injectivity decline.
- ❖ Process engineering review.
- ❖ Operational and chemical activities.
- ❖ Related production chemistry aspects.
- ❖ Solids types.
- ❖ Source water analysis.
- ❖ Operational surveillance and monitoring.
- ❖ Waste materials and waste sources.
- ❖ Wax and asphaltenes deposition, and mitigation.
- ❖ Wells and flowlines.

Oil Plus has the capability to perform detailed investigations into the formation damage mechanisms for various well types, from laboratory simulation testing (coreflooding experiments with associated fluid, rock and fines compositional analysis) to the design, management and monitoring of actual field well tests.

Our usual approach to any downhole formation damage problem is to perform an extensive on-site data review, covering all the reports of well testing performed, fluids and retrieved downhole solids sample analyses, well configuration / logs, core analysis data, etc. Oil Plus combines the disciplines of geologists, well technologists, completions, reservoir and petroleum engineers and production chemists to carry out a full data review.



From this review, additional analytical work is recommended and then laboratory simulation testing is carried out to narrow down the possible damage mechanisms to a single, or combined candidate. Remedial treatment will then be tested in laboratory simulations and the optimum treatment option identified.

Finally, Oil Plus will recommend the most cost-effective and technically optimum well remediation treatments and can implement the treatment by designing and managing well remedial treatments in well tests. These could include well step rate injection tests, fall-off tests, tubing cleaning tests, injection / acidisation combination tests, etc. Correctly designed monitoring programmes will be set up on-site for each specific field.

Following successful completion of the initial test programme, Oil Plus can handover the developed treatment and monitoring programme to the operator for future testing. On-site training of such personnel and temporary operational support normally finishes our involvement for such projects.

It is well known that Oil Plus has been involved in investigating the cause of some of the most infamous operational shut-downs in recent years, and only our expertise and past project experience, ensured the client had a successful resolution to the problems at hand.

HOW DOES OIL PLUS DETERMINE WATER INJECTION PARAMETERS AND SYSTEM DESIGN?

Oil Plus has the required expertise and experience, supported by its laboratory facilities, specialist on-site equipment and process simulation computer modelling software, to develop and achieve the most cost-effective solution for your operational issues. Our strategy for addressing water quality and injection includes:

- ❖ **Data gathering** – review of client's data, on-site sampling and analysis of fluids.
- ❖ **Expert interpretation** – determine root-cause of problem based on analysis of the evidence.
- ❖ **Mitigation recommendations** – these may involve operational, chemical or process changes.
- ❖ **Recommend monitoring regime** – to ensure that the monitoring programme is timely and sensitive enough to identify performance deterioration before it becomes problematic.
- ❖ **'Live intervention'** – can be carried out in some circumstances, e.g. making changes whilst monitoring the plant and feeding back the result to refine the changes.

Our proven methods and extensive practical experience allow us to provide clients with cost-effective results-driven mitigation strategies. Our specialised equipment and experienced professionals guarantee efficiency, accuracy and superior results.