Improve oil recovery with real-time monitoring of water injection wells using WPM’s Water Injection Performance and Diagnostic Module (WiPD).

**Monitor Water Injection Conditions from your Desktop**
Part of Honeywell’s Well Performance Monitor solution for comprehensive well and field surveillance, the WiPD module brings the same level of insight to water injection.

Through continuous – and real-time – water injection performance monitoring, WiPD vastly increases engineers’ and operators’ visibility and ability to control the injection process:

- Identifying formation plugging and fracturing conditions sooner and more easily
- Monitoring pre- and post-breakthrough scenarios using its Enhanced Hall Diagnostics plot
- Tracking reservoir pressure support
- Tracking total cumulative water volume and injection time
- Monitoring reservoir pressure against water injection over time.

The result is more accurate monitoring and control of the injection process for significantly higher medium and long-term oil recovery.

**An Old Problem**
Using water injection to stimulate oil production has the potential to significantly increase hydrocarbon recovery. Injection wells used to pump water into the reservoir help maintain pressure, encouraging flow to producing wells nearby.

To maximize the benefits, however, careful control of the water injection rate is required to maintain a correct and consistent pressure for optimal recovery. Unwanted conditions like fracturing, allowing injected water to flow to unwanted zones and not to the targeted zone, or plugging, reducing transmission to the targeted zone, significantly impact the ability to maintain appropriate water injection. Consequently, many efforts have been made over the years to develop methods to monitor and evaluate water injection well conditions and detect signs of these problems.
A New Solution

The WiPD module allows continuous real-time monitoring of the entire injection process through a clear user interface.

Easy to read plots display a variety of key performance indicators automatically calculated using real-time data, allowing even inexperienced engineers and operators to quickly and reliably detect changes in water injection performance and the development of issues.

Central to the solution is an enhanced Hall integral calculation methodology based on a complete reformulation of the Hall method. This allows both pre- and post-breakthrough scenarios monitoring, and capable of clearly picking early signs of fracturing or plugging.

Figure 2 shows the solution’s Enhanced Hall Diagnostic Plot based on the new method. The green series illustrates the Hall integral calculation, and the white and blue series illustrate the numeric and analytic derivatives of the Hall Integral. Deviations of the derivatives above the integral (indicating potential plugging) or below (indicating potential formation fracturing) can clearly show developing problems. This provides unambiguous diagnosis of the injection well which is more sensitive than slope changes in traditional Hall plots.

Furthermore, while the traditional Hall method works most effectively only on post break-through, where minimal pressure changes at the oil/water interface occur, and the enhanced method is applicable and effective at all times in pre and post-breakthrough.

Particularly useful at inception of flooding, users of the new method can monitor injection KPIs, including the expanding water-bank radius, for effective injection monitoring from inception to breakthrough. Automatic alerts can be programmed to alert users when KPIs deviate from expected results to enhance early detection of problems.

KPIs and Plots for Closer Control

Users of the WiPD module have access to a variety of additional KPIs for historical analysis and real-time monitoring as well. These include downhole pressure while flowing; water bank pressure and water bank radius; and a pseudo skin (an indication of formation damage).

A number of additional plots provide in-depth insight into injection well and reservoir conditions at a glance (Figure 3):

- Skin and Pwf Surveillance Plot
- Reciprocal Injectivity Index Surveillance Plot
- Water Bank Pressure (Pe) and Radius (re) Surveillance Plot.

Enabling users to monitor injection pressure at bottom hole and at water front, as well as keeping track of cumulative injected volume and injection time, WiPD gives insights for continual and close control of reservoir pressure for maximum recovery.
Comprehensive Services
Honeywell offers full services for users of WiPD. From the site survey and requirements gathering to pilot deployment, it will tailor the solution to your requirements. Ensuring integration with existing field automation and data historians and programming client-specific reports and workflows, we offer a turn-key solution for injection well monitoring.

WiPD comes with worldwide, premium support services through our Benefits Guardianship Program (BGP), helping customers improve and extend the usage of their applications and the benefits they deliver.

Benefits
WPM's Water Injection Performance and Diagnostic Module offer unparalleled monitoring and analysis of the injection process:

- Enhanced recovery through early detection of fracturing and plugging
- Clear detection of even subtle changes in well conditions
- Elimination of errors and reduced workloads through automatic calculation and plotting of advanced water injection KPIs
- Enhanced safety through avoidance of pressurization of unwanted reservoir zones
- Injection KPI tracking for pre- and post-breakthrough scenarios for a more comprehensive monitoring
- Configurable alerts to aid detection of problems by even inexperienced workers.

Support Services
This product comes with worldwide, premium support services through our Benefits Guardianship Program (BGP). BGP is designed to help our customers improve and extend the usage of their software applications and the benefits they deliver, ultimately maintaining and safeguarding their software investment.